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# ELECTRICAL REVIEW

FOUNDED 1872

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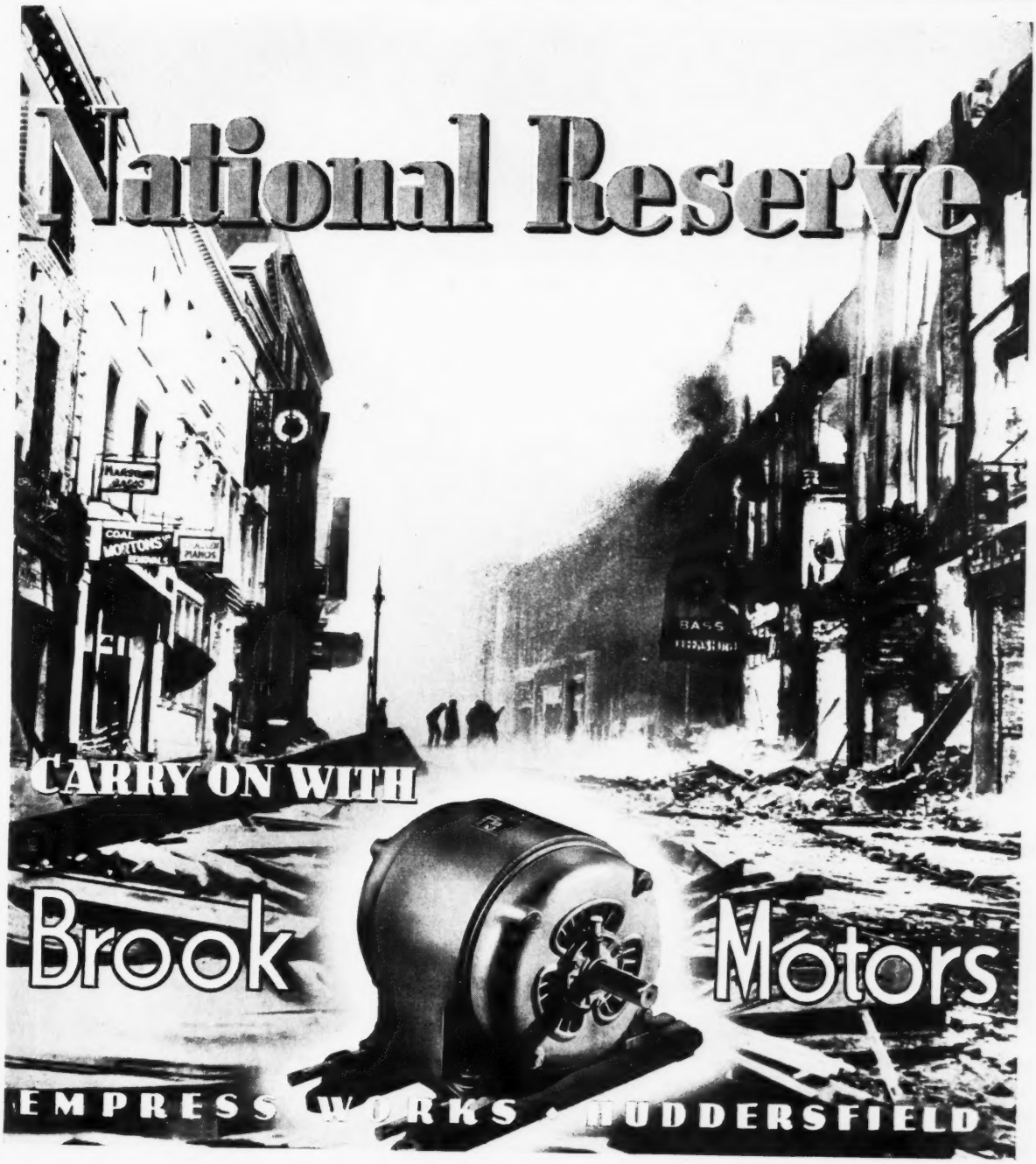

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# THE ELECTRICAL REVIEW

Volume CXXVIII — No. 3310

Friday, May 2, 1941


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THE
# ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXVIII. No. 3310 MAY 2, 1941 Price SIXPENCE

# Industrial Heating

## *A New and Wider Outlook Required*

ABOUT ten years ago a particularly successful development in the pottery industry was the introduction of electric kilns for the firing of colour-printing and decorations on to previously hardened wares. This operation demands temperatures of about 900 deg. C., while temperatures of the order of 1,350 deg. C. appear to be necessary in the fuel-firing kilns in which the pottery is biscuit-fired, that is, fired from the green clay, and glost-fired for glazing purposes. At that time we seriously suggested to both the pottery and electrical industries that both biscuit firing and glost firing might also be effected electrically.

### An Outstanding Success

We think that some experts in both these industries felt we were a little frivolous at making so revolutionary a suggestion, while kinder folk thought we were rather premature and that the development was one which might be enjoyed by some generation in the dim future. Elsewhere in this issue we have shown that now, only ten years later, electric biscuit and glost firing are an accomplished fact, and an outstanding commercial and technical success for both the potteries and electrical firms.

Our object in making a special point of this is not to indulge in a cheap " we told you so," but in the interests of the electrical industry as a whole we again stress most strongly that there are tremendous prospects for all kinds of electric heating once a more progressive outlook can be fostered within the electrical industry. We believe that industrial heating is probably the industry's biggest potential field and that there is so much electric furnace business awaiting capture that a new and wider outlook is required.

It is a reasonable assertion that an electric furnace consumes its capital value of electricity in about two years, and it also creates a considerable demand for transformers, switchgear, and converting machinery. Why are the prospects of electric heating so good? Because there is no other heating medium which can afford anything like the uniformity of heat distribution which can be obtained electrically, and because the very special degree of fineness of control which is inherent in electrical heating is reflected in the control of production. High-grade steels are now essential to modern methods of production, and electric melting is the only means of producing very high-grade steels. Further, for the heat treatment of high-grade steels, exacting conditions of temperature control are imposed, and this is a matter in which electricity must always score.

The development at Barlaston, described in this issue, has many parallels in industry generally, but one in particular bears on the type of heating replaced. Many electrical engineers are too fond of raising the warning finger at any mention of crude heating. This, they say, must be left to the cruder methods of heating—what nonsense! After seeing in the pottery country saggars filled with green pottery being stacked away in a biscuit kiln over a lengthy period one can hardly imagine a cruder form of heat. But what of the result of conversion to electric heating? It has been discovered apparently for the first time in the centuries-old history of pottery that nothing like so high a temperature as was thought necessary is needed, and actually the designed temperature of the electric furnace is as much as 200 deg. C. lower than previously specified temperatures.

### Elimination of Waste

In the saggar kilns very large quantities of wares are wasted as the result of over-firing and distortion, both due to uneven distribution of heat. These wastages have been almost entirely eliminated in the electric kiln. Is there then not an outstanding case for replacing the cruder methods of heating by the more scientific, more easily controlled, and hence more practical, method of heating, particularly when we are assured by the pottery management that from their viewpoint of major interest—economy—the modern method of firing is an unqualified success?

When very recently we were able to show what big advances had been made in electric heating and how important they were at present, we found it advisable to visualise the modern electric furnace as a precision machine tool in order to help to create an outlook which could grasp the importance of the electric furnace to the war effort. The influence of the electric furnace is felt in the execution of practically every type of

armament work, heat treatment alone embracing such extremes as the bright annealing of cupro-nickel bullet envelopes and the heat treatment of big guns. But here again we heard too much of such things as crude heating and licking flames as essentials that should be dissociated from electric heating. We believe, and again seriously suggest to all those concerned that in every case the treatment, whether high or low temperature, or melting or heat treatment, can be done better electrically. But it is first necessary to remove the blinkers of prejudice and bias which appear to have for so long a time limited the vision of many of those responsible for wider electrical development.

**New Mining Regulations**

THE report of the Thornton Committee on the Mining Electrical Regulations, reviewed by us this week, should be read in conjunction with the articles by Mr. J. A. B. Horsley and a leading article that appeared in issues of this journal last November and December. While the new draft Regulations give more specific guidance in important instances in the light of experience than the last code, which was drawn up in 1913, they lay down general principles rather than detailed procedure, the object being to avoid as much as possible the need for further amendments to keep pace with advancing technique. The aim of the Committee can, however, be fully achieved, we believe, only if the present requirements are followed by one dealing with the certification of colliery electricians, as recommended by the Royal Commission on Safety in Mines.

**The National Register**

IT was only to be expected that the war would have an adverse effect upon the National Register of Electrical Installation Contractors. Indeed, before the war a slowing-down had occurred owing to the fact that a large part of the "cream" of the contracting industry had been skimmed. As we have already mentioned, the demand for men—both skilled and unskilled—has had a serious effect upon the electrical contracting business and this has been coupled with a scarcity of the normal work upon which installation men depend. Consequently many registered contractors have gone out of business and the decline during 1940 of over 9 per cent. was not unexpected—it might easily have been greater. The Executive Committee aims at keeping the Register in a flourishing condition ready to meet the conditions which will arise after the war when there will be a flood of electrical installation work of all kinds.

**Good Red Herring**

HITHERTO the only fish of electrical significance we can recall have been such exotic species as electric eels which act as high-voltage generators. Now the homely herring claims attention for its electro-magnetic reactions, even though these are man-made. The herring provides the backbone (and flesh) of the important meal and oil industry of British Columbia, and in order to conserve the supply of raw material, its life and habits and rate of growth have come under investigation. Metal tags, engraved with relevant particulars, are inserted in selected captives, which are then turned loose in the Pacific until chance or nostalgic yearnings result in their being caught again. Together with others not distinguished by interior decorations they travel by conveyors towards the reduction plant passing through the coils of an electro-magnet on the way. The select few cause the magnetic detector to open a trap in the conveyor floor through which they drop to a bin for examination of the identity discs. Thus, at the expense, we hope, of only a slight discomfort, these chosen fish have the privilege of helping to increase the number and improve the quality of their species.

**Bathroom Fatalities**

EVIDENCE continues to accumulate of the need for continuously warning the public against the use of portable electric fires in bathrooms, the "repair" of electrical appliances by handymen and the purchase of shoddy goods. Two recent cases at Birmingham illustrated the risks run by the ignorant or careless. In one a youth was found dead in a bath. He had apparently run flex from a lampholder in the kitchen to a portable fire in the bathroom. The flex was in two pieces and the connection was not properly insulated and it appeared he had touched the ill-made joint and received a fatal shock. The other case was that of a young man who was using a portable fire which he had repaired some time earlier. In making the repair he had left a part of the element in contact with the frame which, of course, was not earthed. Upon touching the fire while he was in the bath he, too, was killed. Such cases as these receive prominence at the time in the Press but the public memory is very short and regular reminders should be published by supply authorities.

**Useless Records**

AMONG the economies that can be effected by a systematic review of an organisation is the suppression of useless records. Unless these are kept with an intelligent grasp of the purpose they are designed to serve they are more than a dreary waste of time. They cumber the ground and make it more difficult to lay hands on information of real value. It is one of the aims of "job analysis" to eliminate the copying of details merely because at some time in the past they were found useful. This is one of the aspects dealt with in the address of the present chairman of the I.E.E. Argentine Centre, Mr. M. F. Ryan, who shows that job analysis (which he discusses in relation to a railway undertaking, but which he considers could be profitably applied even to the smallest concerns) enables the efforts of the staff to be efficiently directed to the most serviceable ends.

**Starting AC Motors**

FOR the purpose of reducing voltage fluctuations due to the starting of AC motors, it is generally accepted that any restrictions imposed by supply authorities should be based on initial current rather than on horsepower or type of motor or of starter. This was the basis of the recommendations made jointly by the I.M.E.A. and B.E.A.M.A. some six years ago. A similar committee representing supply undertakings and manufacturers is to be set up in the United States, where regulations based on current taken coupled with frequency of starting seem likely to be introduced. The auto-transformer method is not much favoured as it causes two peaks instead of one with direct-on starting.

**Travelling Capacitors**

FOR voltage control on a large high-voltage distribution system during emergencies, the use of a mobile electric condenser seems well worth consideration. The Pennsylvania Power & Light Co., which has a trailer-mounted unit (complete with ancillary gear) in commission, finds that it fulfils other purposes also, such as maintaining service during repairs to or changing of equipment and in saving overtime on work that would otherwise have to be carried out during off-peak periods. It is also to be installed temporarily at various points on the network where voltage regulation is unsatisfactory, in order to determine accurately the value of the permanent capacitors required. The capacitor is rated at 1,080 kVA and is cut in and out automatically in 180-kVA steps and is readily connected for either 2,300-V (delta) or 4,000-V (star) operation. For certain purposes it would seem to be more suitable and less expensive than a mobile transformer.

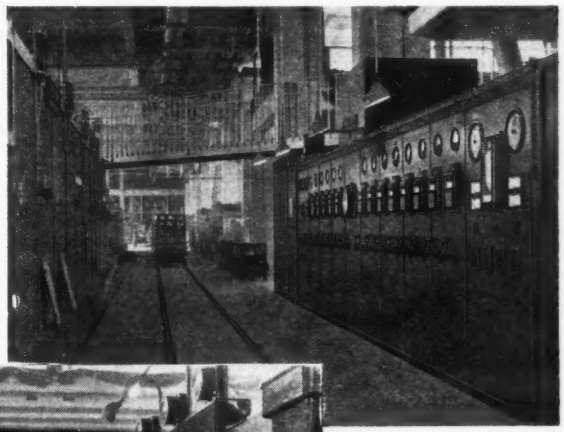
# Industrial Electric Heating

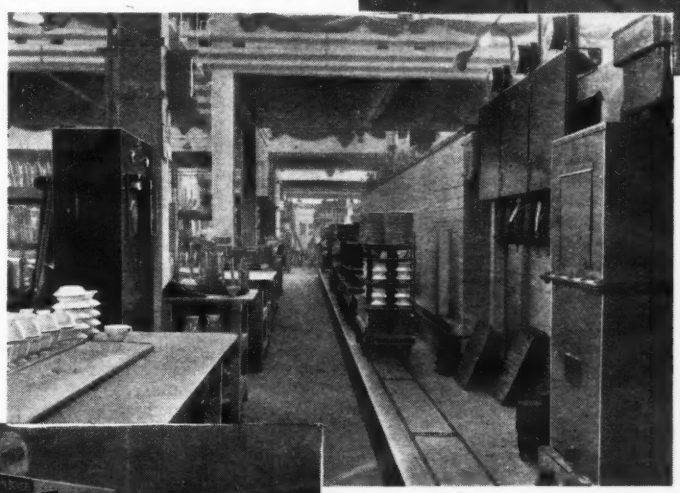
## *Conveyor-type Double-oven Kilns*

*In our issue of April 18th, we described the electric driving and handling methods at the new Barlaston works of Josiah Wedgwood & Sons. This article deals with the firing arrangements which possess some entirely new features.*

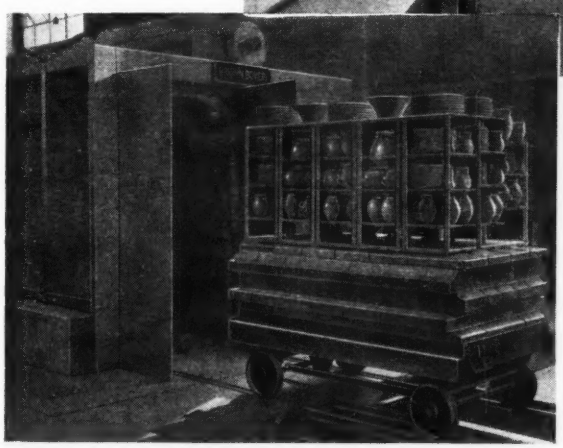
WE stated in the first part of this article that Messrs. Wedgwood's works at Barlaston were in the front rank in production methods, and if we have not already substantiated that statement by our description of the driving arrangements we have only to add that for the first time in the history of the pottery industry in this country electrical open biscuit firing has been adopted. And it is the first time that electrical biscuit and glost firing have been combined in one kiln in this country. Biscuit firing is hardening the " green " clay products and glost firing is hardening the glazing solution applied by dipping to the hardened but porous articles after biscuit firing to render them impervious to liquids. Both firing processes require temperatures up to between 1,100 deg. C. and 1,200 deg. C.

By open firing is meant that in which the pottery is subjected to direct radiation from the source of heat instead of being stacked in the kiln in saggars—special containers. But to the electrical man the special significance of the term open firing is that it is essentially electric firing. Both the biscuit and glost firing are effected in a double-tunnel kiln of the conveyor type. The two tunnels—one biscuit and one glost—are side by side so as to reduce construction costs and effect a measure of heat recuperation. In each tunnel there are a heating-up and a cooling-down section at opposite ends of the firing zone, and the sequence in the case of biscuit firing is opposite to that of glost firing.





**Above : The central control board for the biscuit and glost firing kiln. Left : Central portion of enamelling kiln, showing control board on left and voltage regulating arrangements, busbars and contactor on kiln wall (right)**



**Truck with " placed " ware about to enter the biscuit kiln**

The overall length of the kiln is 272 ft. and the firing zone is about 100 ft. long. Each tunnel measures about 6 ft. by 4 ft. inside, just a little larger than the trucks which convey the wares through the kiln. On either side near the bottom of the tunnel is a trough of sand into which dips an extension of the metal framework of the truck, thus forming heat seals to guard against heat projection or wastage into the trough base of the kiln, while refractory projections from both the tunnel walls and the trucks interlace to form heat baffles.

A most important consideration in the operation of the kiln is the obtaining of a precise heating-up curve to suit the wares. Steady heating-up is vital to their sound production and, indeed, to their acceptance for the market. In addition to the correct disposition and loading of the elements attention paid to the blowing of preheated air into, and drawing it through, the kiln plays no small part in obtaining the desired curve. To this end there is a fan of specially chosen size at either end of the tunnel. The total loading of the complete kiln—biscuit and glost—is between 300 and 400 kW.

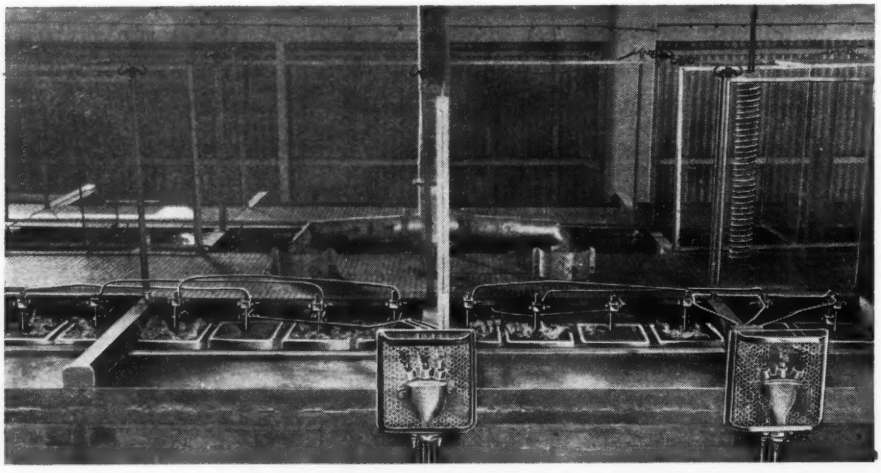
The firing zone of each tunnel has a number of sections, the temperatures of which, as recorded by pyrometers on the outside walls and at the centres of the sections, follow a desired curve in each case, with a maximum in the case of biscuit firing of about 1,150 deg. C. The important thing, however, is not the temperature at any one point, but the knowledge it gives to the fireman of what is happening at many points in the section in question.

The elements are staggered to assist even distribution of heat and are balanced on phases. They are vertically disposed in recesses in the kiln lining and they actually rest on a shelf in the kiln wall which takes their weight. " Kanthal" type or aluminium-iron resistor is used for the elements, and in each case strip about $\frac{1}{2}$ in. wide is wound spirally on a refractory former about 3 ft. long, and to the ends of the strip are welded nickel-chrome connecting rods, one for the bottom connection passing completely through the former.

The element is inserted through a hole in the roof of the kiln, the connecting rods above the element proper being carried in an earthenware stud with a central hole for one rod and a groove up the periphery for the other one. Mechanical connections at the rods above sealing collars at the rod holes

in the studs are part of the neat distribution from the sectional trifurcating boxes at the top of the furnace wall. The elements are spaced about 9 in. apart.

Each section is supplied and controlled independently with a star connection and by two contactors. On a central board there is a separate panel for each section complete with a circuit-breaker and a control indicator of the dual-pointer (setting and operating) type. When the black needle passes to one degree above the red needle ("fireman") it automatically cuts out both section contactors through mercury switches and renders the section dead. When the black needle passes to one degree below the "fireman" it first puts into circuit one contactor only, giving the section a loading of 55 A. When the section is brought into circuit again by the regulator, and if the needle has not then moved from the last recording, the other contactor is operated so as to increase the loading of the section to a maximum of 63 A.



**A section at the top of the biscuit firing kiln, showing distribution to the elements and a spare element**

Inside the regulator is a little motor which brings up a bar for checking the black with the red, and it also works the mercury switches.

The trucks run on rails continuously through the kiln end to end as a train, the whole being propelled by a pusher unit which operates with the end truck at the tunnel entrance. A small motor at floor level drives the pusher chain through a gear box and pinion gear with a very considerable speed reduction, while actual engagement between the chain and the truck is by plates projecting from each. For the pusher drive there is a contactor remotely controlled from the pushing gear. When the truck approaches the pusher gear the contactor is operated so that the pusher gear automatically starts up, and when at the far end the truck is two minutes' travel from the end of the pusher a horn operates to warn the attendant, while lights give a visual signal. Two minutes later the truck is brought to a standstill so that there is no risk of pushing the truck through closed doors. A variable-speed pusher gear is installed allowing an easy adjustment of about ± 20 per cent. of the normal speed.

### Maintaining Correct Shape

A most important part of the firing process is placing the green clay wares on the firing trucks in such a manner that they will retain their shape and properties right through the firing processes. Refractory bats are built up in tier formation and the clay articles are bedded with sand on the bats. This placing is highly skilled work but considerably greater latitude is offered in the case of open (electric firing) than in fuel firing, using saggars; for one thing the more uniform heating and finer control almost entirely eliminate wastage from distortion as the result of too rapid contraction.

We have already indicated that glaze dipping is an operation between the two firing operations carried out in the kiln described. A motor-driven endless conveyor carries suspended tiered trays with the dipped wares through a drying oven, following which a very long horse-shoe conveyor forms a reservoir between dipping and firing and a convenient means for "placing" the wares ready for the firing operation. The drying and placing conveyors are driven by 1-HP and 2-HP motors, respectively.

According to the type and quality of the ware decorations are applied before or after glazing, and we saw excellent examples of hand painting and transfer work from engraved copper plate. In all cases such decoration needs firing to remove the oil from the colour and often where more than one colour is used more than one firing is necessary for the purpose. Enamel firing for colour work demands a temperature of about 850 deg. C.—low by comparison with biscuit and glost firing. The enamel firing is also done electrically, but this is not a new development, although, of course, the kiln for the purpose is new. It is a single-tunnel unit and, although smaller, is rather similar in general construction to the biscuit and glost kiln, having the three main zones—heating-up, firing and cooling-off. There are eight elements on each side of the firing zone, six on each side of a second preheating zone and three on each side of a first preheating zone.

The bulk of the thirty-four elements in the kiln have simple hand control by means of a voltage regulator which consists of an English Electric transformer with tap-change variations from 73 per cent. to 92.5 per cent., giving a maximum loading of 70 A per phase. A selected number of the elements, six at the moment, is controlled automatically by contactors and Cambridge dual-pointer indicating equipment in a similar manner to the control in the case of the biscuit and glost kiln. The elements for the enamelling firing kiln are wound on a 1⅛ in mandrel and arranged along the kiln wall in about 6-ft. lengths. Energy is supplied at 240 V.

This enamelling kiln is of Gibbons-Wild Barfield manufacture, while the double-tunnel kiln is a Brown Boveri equipment. Practically all the motors throughout the installation are squirrel-cage machines of Crompton Parkinson and English Electric production, and in each case the control gear is a neat and compact outfit consisting of an Airedale star-delta starter and a Walsall isolating switch, together with a T.C.C. condenser for local power factor improvement.

We are indebted to Josiah Wedgwood & Sons, Ltd., for permission to visit the works, and to members of their staff for help in collecting the above material and taking photographs.

## Progress in Argentina

THE Associacion Argentina de Electrotecnicos has recently published in its official journal *Revista Electrotecnica* a summary of the latest figures drawn up by its Statistics Commission regarding the development and progress of the electric power supply industry in Argentina. It shows that at the end of 1939 there were 949 power plants in the country giving a supply to third parties. The aggregate capacity of the plants is given as 1,170,179 kW as compared with 1,117,613 kW at the close of 1938, an increase of 52,566 kW, or approximately 4.7 per cent.

Of the total, steam-operated central stations represented 918,176 kW; plants driven by internal-combustion engines, 208,917 kW; and hydro-electric stations only 43,086 kW. The outputs of the different plants in 1939 were: steam, 1,938,988,000 kWh; internal-combustion 321,080,000 kWh and hydro-electric 98,565,000 kWh, giving a total of 2,358,633,000 kWh, as compared with 2,214,781,000 kWh in the preceding year, an advance of about 6.5 per cent.

At the end of the year under review power was being supplied to 1,382,301 consumers, whose consumption in 1939 was 1,968,582,000 kWh, an average of 1,424 kWh per head. A diagram shows that the city of Buenos Aires and its suburbs are responsible for 50.5 per cent. of the consumption, and the remainder of the Province of Buenos Aires for 28.9 per cent., leaving only 20.6 per cent. for for the rest of the country.

# PERSONAL and SOCIAL

## *News of Men and Women of the Industry*

IN our last issue we reported that **Mr. L. W. Smith** had been elected chairman of the BritishElectrical and Allied Manufacturers' Association. Mr. Smith, who is managing director of Elliott Bros. (London) Ltd., follows his father, **Mr. W. O. Smith**, who was chairman of B.E.A.M.A. from 1919–1922 and is now vice-president of the Association. It is the

Mr. L. W. Smith

Mr. W. O. Smith

first occasion on which a son has succeeded to the chairmanship after a full period of office by his father.

**Mr. A. J. Percival,** M.I.E.E., has relinquished his position as managing director of Inniss & Riddle (China), Ltd., Shanghai, and sailed on February 25th for England to offer his services. Mr. Percival was educated at Northampton Town and County School and received his training with the British Thomson-Houston Co., Ltd. In 1910 he went to Japan to take up the position of chief engineer to the Japanese Explosives Co., Hiratsuka, with whom he remained until 1919, when he became managing director of Inniss & Riddle (China), Ltd. Mr. Percival was president of the Engineering Society of China in 1939, and was chairman of the F.B.I. China Committee and of the British Chamber of Commerce Engineering Committee from 1936 to 1939. He was also chairman of the China Centre of the I.E.E. in 1933 and 1934. Mr. and Mrs. Percival expect to take up residence at Gerrards Cross, Bucks., later in the summer, but in the meantime correspondence may be addressed to Mr. Percival, c/o Inniss & Riddle (China), Ltd., Sandgate School, Portsmouth Road, Esher, Surrey.

**Mr. J. A. Forde,** J.P., engineer and manager of the Isle of Thanet Electric Supply Co., Ltd., has been co-opted to fill a vacancy on the Broadstairs and St. Peter's Urban District Council. Mr. Forde was chairman in 1928–9, but retired from the Council in 1938.

The George Medal has been awarded to **Mr. J. St. Leger Hunter,** inspector (telephones) Swansea Telephone Area, and **Mr. C. H. Hishon,** inspector (telephones), Portsmouth, has been awarded the O.B.E. (Civil Division) for meritorious service during recent air raids.

We have had a letter from **Mr. A. B. Ryall** who tells us that it is just sixty years ago that he joined the staff of the United Telephone Co. (the parent company of the National Co.). He would like to hear from any of his former colleagues. His address is Hammonds End, Harpenden, Herts.

**Mr. L. S. Wootton,** chief engineering inspector to the Post Office telephone system in the Croydon district, has been transferred on promotion to the Central London area.

**Mr. G. H. Smith-Parr,** A.M.I.E.E., has been granted a commission in the R.A.O.C. and will be taking up his duties at the beginning of next month. Mr. Parr has represented the Electrical Apparatus Co., Ltd., in South Wales and the West of England since early 1939, being originally at Cardiff, but transferring to Bristol last year.

**Mr. T. W. E. Corrigan,** who has retired from the position of manager of the Tiverton Corporation electricity undertaking, has been presented by the officials and staff of the Corporation with an inscribed walnut bureau.

**Mr. W. A. Woodeson** was elected president of the North East Coast Institution of Engineers and Shipbuilders at the general meeting held on April 25th.

**Mr. R. Gretton Lowe,** A.M.I.E.E., A.M.I.Mech.E., of Whitehead Switchgear & Inventions, Ltd., informs us that in view of the contracts involved he is continuing as chief engineer and general manager of the company for the time being in co-operation with Peat, Marwick, Mitchell and Co., appointed by the debenture holders. The arrangement made originally for Mr. Gretton Lowe to join the board of Whitehead Switchgear & Inventions, Ltd., was abandoned a little over a year ago.

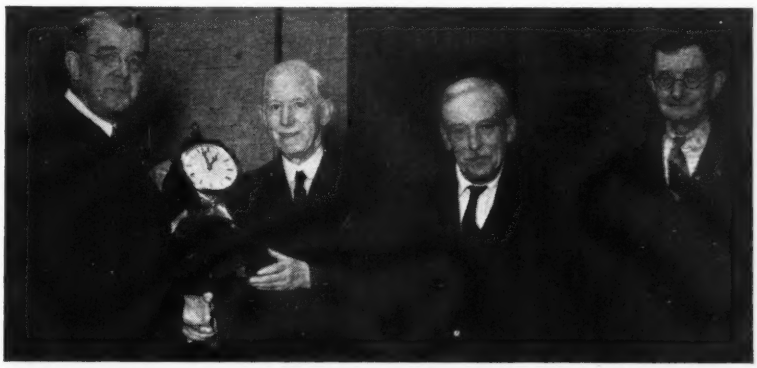
**Sir Thomas Royden** has been appointed chairman of the London, Midland & Scottish Railway Co., in succession to the late Lord Stamp. Sir Thomas is chairman of a number of concerns, including the B.C. & H. Power Station Co., Ltd., Edmundsons Electricity Corporation, Ltd., and the Imperial Continental Gas Association.

**Dr. C. A. Adams,** consulting engineer to the Edward G. Budd Manufacturing Co., Philadelphia, has been awarded the Lamme Medal by the American Institute of Electrical Engineers for his contributions to the theory and design of AC machinery and his work in the field of electric welding. Dr. Adams is a past-president of the American Institute and is a member of the British I.E.E.

**Mr. H. W. H. Richards** has been appointed chief electrical engineer to the London & North Eastern Railway, and **Mr. E. Thompson** has been appointed chief mechanical engineer in succession to the late Sir Nigel Gresley.

**Mr. R. A. Cookson** has been appointed a director of the North-Eastern Electric Supply Co., Ltd.

At Ponders End on April 23rd, Sir Felix Pole, chairman of Associated Electrical Industries, Ltd., made presentations to three Ediswan employees who have recently completed fifty years' service with the company. With these three, the total number of employees to be so rewarded reaches sixteen, nine of whom are still serving in either workshop or office. The three employees who received presentations are Messrs. A. Fairhurst, C. S. Tovell and W. Swallow.



Sir Felix Pole making presentations to three Ediswan employees who have completed fifty years' service

**Mr. W. G. Forte** has been appointed lecturer in charge of the electricity department of the School of Mines, Adelaide. Mr. Forte, who is 28 years of age, graduated at the University of Western Australia with first-class honours in electrical engineering in 1935. After some time with R. P. McInerney & Co., Ltd., in Perth, he joined the staff of Cuming Smith and Mt. Lyell Farmers Fertilizers, Ltd., Melbourne, and later was appointed assistant research engineer to the State Electricity Commission of Victoria.

Croydon Corporation Electricity Committee has appointed **Mr. R. J. H. Lloyd** of the Maidstone electricity undertaking and **Mr. A. Hicks** of the Hastings electricity undertaking as control engineers at salaries of £320 per annum.

**Mr. H. Eagles,** B.Sc., of Aylesbury, has been appointed electricity manager to the Ashbourne Urban District Council.

**Mr. E. G. Taylor,** district engineer for the General Electric Co., Ltd., Manchester, has been elected chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers.

We regret to learn that **Pilot Sergeant C. F. Hitchcock,** eldest son of Mr. A. F. Hitchcock, managing director of Flinders (Wholesale) Ltd., is reported missing. Pilot Sergeant Hitchcock was well known to Eastern Counties radio and electrical dealers, and prior to the outbreak of war represented Flinders in Suffolk. **Pilot Sergeant J. Ratcliffe,** who was electrical storekeeper for Flinders at their Ipswich branch, is also reported missing. Both were members of the Civil Air Guard.

**Mr. W. Guthrie** has resigned his appointment as deputy electrical engineer at Falkirk in order to proceed to work of national importance. The vacancy is to be advertised by the Corporation immediately, and it has been remitted to the convener and vice-convener of the Electricity Committee to draw up a short list of applicants for submission to the Town Council.

**Sir Walrond Sinclair** has been appointed Rubber Controller. The offices of the Control will temporarily be at 12, Whitehall, S.W. The new Controller is chairman of the British Tyre & Rubber Co., Ltd., and of the India Rubber, Gutta Percha & Telegraph Works Co., Ltd. In 1917 he was Director of National Service for the London region.

**Major J. Day** and **Mr. R. W. Foot** have been elected additional directors of the Ascot District Gas & Electricity Co.

**Councillor E. Duckworth,** chairman of the Colne Corporation Electricity Committee, has been appointed as the representative of the Corporation on the Mid-Lancashire Electricity Advisory Board. In his absence **Alderman E. A. Foulds,** vice-chairman of the Committee, has been authorised to act as the Corporation's representative.

**Flying Officer J. M. F. Dewar.**—We regret to learn that Mr. M. Dewar, chairman of British Timken, Ltd., and Fischer Bearings Co., Ltd., and a director of the South Metropolitan Electric Light and Power Co., Ltd., has been bereaved by the loss on active service of his eldest son, Flying Officer John Michael Firth Dewar, R.A.F.V.R. Mr. Dewar is in the United States leading a special mission for the British Government.

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**Wills.—Sir Harley Hugh Dalrymple-Hay,** M.Inst.C.E., left £87,787 with net personalty £67,772.

**Mr. Edgar Moxon,** of Bridlington, former electrical engineer at South Shields, left £4,196 (net personalty £4,086).

# Earth-fault Protection

## *Weak Spots in Present-day Methods*

By T. C. Gilbert, A.M.I.E.E.

IN a letter to the ELECTRICAL REVIEW of March 28th, Mr. C. Turnbull placed his finger upon the weak spot regarding earth-fault protection with most present-day methods, and recent Home Office publications have also stressed the same aspect. The efficiency of any system of protection has been judged rather from the standpoint of shock to the user of equipment, and the—to my mind—much more important matter of fire risk has been to a great extent overlooked. Mr. Turnbull's letter, read in conjunction with editorial advocacy of further research into earthing problems, will help to crystallise present thought on the whole question of protection, which is of especial interest to installation engineers.

Accident returns show that, in spite of shoddy installations and makeshift connections by consumers themselves, electrical equipment must be the safest of all the apparatus handled by the public. The mounting sales, not only by recognised sources of supply but also by the many multiple stores up and down the country, are not accompanied by any great increase in the shock-accident rate, and if only some of this often poor-quality equipment were kept out of the bathroom the casualty returns would drop almost to nil. It is true that a recent rise in the number of accidents has followed a great deal of amateur wiring in shelters of the Anderson type, but such situations are almost as hazardous as the average bathroom, and thus call for special treatment.

On the other hand, fire loss appears to be increasing and this provides yet another reason for an early investigation into present protective methods, especially against earth faults. Mr. Turnbull has detailed several of the weak points, and the Home Office publication, "Electrical Accidents and Their Causes," 1938, provides further food for thought. Mr. H. W. Swann has pointed out that supply-mains earth-leakage current may, in certain circumstances, be transferred to consumers' installation earthing connections, causing a risk of fire. Where protection is against over-current only, earth leakages within its setting, which may attain several hundred amperes on medium-voltage systems, may be sustained, the fault current dividing between the various paths to earth in inverse proportion to their resistance.

*The author stresses the necessity for distinguishing overload from earth-leakage protection and advocates local protective equipment rather than general earthing arrangements*

This is more likely to occur under conditions of aerial bombardment, when underground mains may be damaged. It seems clear that the better the consumers' earthing arrangements and the lower the conduit resistance, the greater will be the chance of really heavy leakage currents entering the installation and dissipating their energy in the form of heat at some point of inefficient contact with other earthed metal. Prevention of this seems to require the complete disconnection of the consumers' earth connections from either underground cable sheathing or even water piping systems. This is only one point that will require serious consideration in future investigations into earthing problems, and it might be as well to see whether our whole idea of the subject does not require reorientation.

### Protection Against Fire and Shock

For instance, dividing the problem into two halves, protection against fire and protection against shock, we find that the requirements for one half do not necessarily coincide with those of the other. Elimination of the fire risk means that we have to get rid of the very heavy earth-fault currents passing over comparatively poor conductors, *e.g.*, steel, cast-iron and lead, which are, in addition, usually uninsulated. I am of the opinion that the risk is somewhat increased by the widespread use of quick-acting fuses, excellent as they are for *overload* purposes.

In the Home Office publication above referred to, it is stated that "the pursuit of effective rupture capacity has led to some danger of ineffective overload protection; as an example, a selection from the stated performances of fuses rated at 300 amperes shows that, depending on the make, they may require between 400 and 570 amperes to melt in thirty minutes, whilst currents varying between 475 and 850 amperes may flow for any time less than one minute without melting the fuse." I suggest, therefore, that the first thing to do is to devise some protective method which will be independent of the overload devices in the circuit; in other words, a leakage must be treated as such, and not forced to become an overload.

Regarding protection against shock from leakage voltage extended on to metal casings, etc., further new and independent thought is required. What are the risks set up? That the user may receive a shock from the live casing which he is touching, whilst making contact with some other earthed material, *e.g.*, a conductive floor or another metal object. It is assumed that the metal casing is connected by means of a heavy—and expensive—earth continuity conductor, passing all the way to the transformer earth electrode or neutral point, with the possibility of discontinuity or of high resistance at some point. In that case it would cease to operate efficiently as a protective measure against shock—because the fuse cannot blow. To the user of equipment the danger lies between the metal casing and the conductive floor or other metal within reach of hand or foot.

I would suggest, therefore, that consideration be given to the connection of protective equipment between the metal casing and, in a domestic installation, a hot-water radiator, for instance. This equipment would preferably be of a voltage-operated type, which would render it independent of the circuit overload devices. Under present regulations I may not use a hot-water radiator as an earth electrode, even for an earth-leakage circuit-breaker, but I can see no real reason why not. These are the points between which the consumer will receive a shock in the event of leakage, and it would not seem necessary to extend protection any further; as soon as a dangerous voltage appears between the metal casing and the hot-water radiator, the protective equipment should be arranged so as to isolate that metal casing.

The factory worker operating a machine incorporating several motors is concerned with a difference of potential upon the machine casing and the floor upon which he stands, and not some remote earth electrode. Why then should many yards of vulnerable copper conductor (introducing its own voltage drop) be employed to shunt him and in effect connect him to the remote electrode, when protection could be secured by means of a voltage-operated device connected between his machine and the floor? There must obviously be a rise of potential between these points before the worker can experience any shock.

One terminal of the protective device could be connected to the nearest point of structural steelwork standing upon the floor or embedded in it. In a domestic installation, structural steelwork would provide a suitable electrode, although I should much prefer to make connections between, for instance, the metal casing and the hot-water radiator; in fact, completely shunting the user by means of a protective device. At any rate, I put this point forward for consideration.

At the end of all investigation, however, it will be found that the best protection against earth fault is insulation. The use of non-metallic wiring systems will cut out most of the present trouble, and for ordinary lighting circuits their use may rapidly become general under the present restrictions on the use of metal. In the earth-free room the regulations already provide for a relaxation of the earthing rule for metal-clad equipment, and the hazardous situations, the bathroom and the kitchen, should be treated in accordance with their particular requirements.

If one dared prophesy in connection with so complicated a matter it would be to the effect that in years to come we shall find earth-fault protection applied locally, at the actual points of hazard, and not extended all over a building, to remain completely unwanted in most of the situations covered. The money saved could be expended on more outlets and equipment, thus benefiting all concerned.

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## Engineers and the Central Register

AT a recent meeting of the Council of the Association of Supervising Electrical Engineers it was reported that discussions had taken place with the Central Register, and in particular with reference to cases where those who had registered had been informed that they were not now included in the Register. It was pointed out the main object of the Register was to secure engineers for certain types of positions, and it had now been agreed that where the applicant for registration was the type of engineer for which the Central Register could not expect to find a position, he was transferred to the Supplementary Register. This did not, however, affect the collaboration between the Central Register and the A.S.E.E. Register.

# CORRESPONDENCE

*Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions.*

### Modern Brickmaking

IN their letter on page 562 of your issue of April 18th, Crompton Parkinson, Ltd., are right in stating that the factory installation described in the ELECTRICAL REVIEW of March 7th is a case where the consumer makes the best use of auto-synchronous motors, but may I be allowed to state that the comparison is incomplete without considering the possibility of power factor improvement by condensers.

While, owing to the reduction of losses in transformer and cables, it seems sufficiently correct to neglect the additional consumption in kWh compared with induction motors, this is not so with regard to a combination of induction motors and condensers. It can be roughly estimated that the load of the plant in question is higher by about 3–4 kW than it would be if the installation power factor were corrected by condensers. On the other hand, the capital outlay would be higher by about £200, so that it is running hours alone which must decide which means of power factor improvement is the more economical.

The difference per year under the mentioned tariff is approximately : At 1,200 running hours, £15 ; at 2,400 running hours, £30 ; at 4,800 running hours, £60 ; at 7,200 running hours, £90 ; at 8,400 running hours, £105. The longer the working hours the more the use of condensers is to be recommended. At 4,800 hours, for instance, the running costs per year would be less by £60 − £20 = £40, if £20 or 10 per cent. is taken for interest and depreciation.

*Birmingham.* ALFRED STRAUSS.

### "Force-Trip" Devices

In your issue of April 11th Mr. R. T. Lythall sets out very ably a case for using high-rupturing-capacity fuses in conjunction with oil circuit-breakers for 400-V circuits. In presenting his case, he compares this combination with a breaker using a "force-trip" device, and, quite erroneously, claims that it can be shown that such a device has a "blind spot," and deduces that this may lead to consequences more unfortunate than had the device not been fitted. This opinion cannot remain unchallenged, as "force-trip" devices are widely used for circuits of all voltages, and they take many forms.

In order to convince other engineers of the fallacy which has tripped Mr. Lythall, I carried out a series of tests with and without a mechanical "force-trip." These tests showed that instead of a "blind spot," there was a considerable range of overlapping current where the breaker would close and latch if there were no "force-trip," and on the other hand would open instantaneously if the "force-trip" was fitted. The days have gone when circuit-breaker performance was a matter of opinion, and no circuit-breaker engineer should be content with anything but test data.

Finally, the preferred term in B.S.936 is "Making-current Release," and the definition reads as follows :—

> "25. A Making-current Release (force-trip release) is one which, during a closing operation, causes a trip-free circuit-breaker to open automatically and without intentional time delay when the making-current exceeds a pre-determined value."

*Manchester.* HERBERT PEARCE.

### Post-war Electricity Supply

May we express our appreciation of Mr. G. Dennis Bond's letter in your issue of April 18th? We agree that the intensive development of the domestic load will offer the only general solution of the post-war problems of electricity undertakings, of which there are as many non-statutory undertakings as authorised; obviously smaller, as "non-stats" vary from two consumers to 3,000 consumers.

At the same time we would like to add that before and during the war we have seized every opportunity to secure higher volts, when they have become available, to enable homes beyond the technical limits of locally generated voltages to receive electricity supply, and, wherever such supply provides means of reducing the tariff, that is done also.

In many cases the "non-stat" supplies are sold at lower rates than the authorised supplies, but in notable cases the authorised bulk supplies are the only source for "non-stat" distributions where the local homes derive maximum benefit.

Association of Non-Statutory Electricity
*Herne Bay, Kent.* Suppliers and Distributors,
J. E. GREEN,
*Chairman.*

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With reference to the correspondence on this subject, the most fruitful way of increasing the use of electrical appliances is to reduce the price of electricity, as most of us cannot afford to run an all-electric house with energy at, say, 1½d. per kW, plus a fixed charge. If the industry will supply us with electricity at ½d. (or less) per kWh, with a reasonable fixed charge, there will be no lack of demand for electrical appliances and current. The average Englishman (and woman) is not nearly so conservative or old-fashioned as is frequently supposed; it is largely a question of £ s. d. that prevents greater use of electricity.

As a step in the right direction, I suggest that the electrical industry should approach the building industry on the following matters, with a view to reducing the cost of the electrical heating of houses: In my opinion the modern small house has far too many windows. I have lived in both old and modern houses, and my experience is that more B Th U's are required to warm a room in the latter than in the former, under comparable conditions. The present tendency (i.e., pre-war) is for builders to construct "glass houses" instead of brick houses.

Again, the thermal resistivity of the modern building materials appears to be less than that of the materials used (say) fifty years ago, and from this standpoint modern houses are appreciably worse than old ones. I am aware that research has been carried out by the Building Research Station, on this subject, but as so often happens the results have not been applied in practice.

*Epsom, Surrey.* H. C. C. C. SILVER.

### Commutators and Brush Gear

In the article under the above heading in your issue of April 18th, it is recommended that brushes should be staggered on alternate arms in order to avoid grooving of the commutator. Actually this arrangement would increase the tendency towards grooving. It has been definitely established that commutator wear is very much heavier under a "cathodic" than under an "anodic" brush, from which it follows that each brush track should be swept by the same number of brushes of each polarity. This matter was dealt with by the paper entitled "Carbon Brushes considered in relation to the design and operation of Electrical Machinery," by P. Hunter-Brown (*I.E.E. Journal*, Volume 57, No. 279, February, 1919). The statement on this subject then made has been amply supported by many subsequent technical publications.

The statement is made that if the brush-holders are inclined at a small angle from the radial the machine will commutate perfectly in one direction only. There are many reversible machines in service running with non-radial brushes on which the commutation is "black" even under severe loading conditions, irrespective of the direction of rotation. A number of large rolling-mill motors are cases in point and some constructors prefer the non-radial brush for this type of service because experience has shown that increased brush stability has given better commutation than when radial brushes are employed.

It is also stated that when the brush is inclined, commutation will only be satisfactory with the direction of commutator rotation indicated by fig. 4, which illustrates a reaction brush. Side grooving is said to result invariably from the use of a trailing brush. Trailing as well as reaction settings of brushes are widely employed in practice and there are certain merits prominent in each. It is necessary, however, for best performance to employ a suitable angle of inclination from the normal, according to the setting selected. Reaction brushes should be inclined at approximately 35 deg. and trailing at about 7 deg. from the radial. Both these settings, especially if combined with a suitable top bevel, give satisfactory operation and do not give rise to side-grooving unless mechanical conditions are extremely severe.

Under the heading of "Consistency in Brushes" the recommendation is made that where conditions demand the mixing of different brush qualities these should be distributed among the rocker arms and on no account should they all be fitted to one arm. The best possible arrangement for mixed grades is to have an equal number of both so arranged that one quality is used entirely on the spindles of one polarity. This arrangement avoids the dangers of selective action between individual brushes.

If the use of a few brushes only of a different grade is imperative it is probably desirable that they should be concentrated on one spindle rather than distributed irregularly among the various spindles of the machine. While the concentration of the brushes on one spindle may affect the share of the total load which the spindle carries, this is unlikely to have as detrimental results as might result from indiscriminate distribution of the brushes.

*Carshalton.* C. J. HEWS, A.C.G.I., A.M.I.E.E.

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Regarding Mr. J. E. Noble's article in your issue of April 18th, the importance of perfect soundness of the commutator cannot be overstressed. In the case of a large 1,000-RPM motor generator, bad commutation was traced to the commutator being 1½ thousandths out of "true."

If a machine is large enough to have pedestal bearings, there is no justification for removing the armature, and a much more

satisfactory result will be obtained by grinding on the spot. There are several methods of driving the armature during grinding, and it will probably be impossible to run a motor on its own power unless the armature is over 4 ft. in diameter, because under this size at least one brush arm would have to be removed to admit the grinder. The armatures of medium-size motors (up to about 300 HP) are usually driven by a small spare motor either through a belt over the armature half coupling, or by direct coupling. Motor generators present no difficulties, the speed of the commutator being immaterial for grinding. Rotary convertors can be run by the pony motor, provided that any electrical connection is removed between it and the rotor windings (follow an instruction book here), and care is taken to prevent overheating of the pony motor.

The risers and windings of the rotor should always be shielded and, although dust will still percolate, solid particles which would not be removed by blowing are definitely excluded. The shielding can be done with a sheet of brown paper, first cutting out a ring of internal diameter equal to that of the commutator, and external diameter about 3 in. bigger than the armature diameter. Slits are then cut radially outwards from the centre, and of length about ½ in. less than the length of the risers. The ring is cut and passed over the commutator, when a well-fitting cap can be formed, the slits allowing the excess paper to overlap. The whole cap is encased in adhesive brown paper ribbon and allowed to dry overnight. This arrangement has been used successfully at 1,900 RPM. Before grinding, maintenance engineers should get into touch with the makers of their machine, as complete grinding tackle is often available for hire.

If a machine has not got staggered brushes, care should be taken to mark the limits of end-float before moving any holders too close to the risers. If one brush arm is sparking more than others, the spacing is probably at fault. The best way to check this is to pass a length of *dry* gummed paper strip round the commutator under the brushes, and mark a corresponding edge of each brush arm on the paper. This should be done at both ends of the brush arms.

The effect of reversed interpoles is likely to be spectacular, and the commutator would probably require re-grinding. Chronic sparking can often be cured by adjustment of the air-gap in the commutator-pole circuit, but this should be carried out by the makers.

The position of the brush yoke may be at fault, and this can be checked by use of the marks on the end of the commutator segments in conjunction with the winding coil connected to these segments. This coil is usually painted white and should be placed centrally under a pair of poles. In this position the segments marked should be under a set of brushes. This is only a rough guide for a non-reversing machine, although it is probably the best position for a reversing machine. The best position for a non-reversing machine can be found accurately by measurement of brush drop as explained in a good textbook, or simply by trial and error movement of half a segment at a time until the best position is obtained.

Bedding of the brushes should be done with glasspaper rather than emery cloth. The edges of the segments should be bevelled, after undercutting, by filing, and if slight scratches are formed by accident, these can safely be ignored.

Most of these points will already be familiar to skilled maintenance men, but it is recommended that anyone attempting to service a DC machine for the first time should obtain experienced aid.

*Chester.* I. ARROL.

# Registered Electrical Contractors

## *Annual Meeting and Report*

PROCEEDINGS at the annual general meeting of the National Register of Electrical Installation Contractors held on Friday, April 25th, were purely formal. Referring to the report and accounts, which were adopted without discussion, Mr. W. R. Rawlings, the hon. treasurer, mentioned that for the first time in the history of the Register both revenue and expenditure showed declines. The decrease in revenue was due mainly to a fall in membership and renewals, while the lower expenditure was achieved by savings in publicity and advertising, office expenses and salaries. The actual results spoke well for the management. Liquid assets at £8,700 showed a considerable appreciation.

Nominations for membership of the Registration Board were approved, namely Mr. J. D. Spark, in place of Mr. J. W. J. Townley, for the I.M.E.A., and Mr. D. B. Irving, in place of Mr. R. N. Berry, for the Central Electricity Board. Both these gentlemen were also elected to membership of the Executive Committee, Messrs. W. H. Walton, F. W. Purse and A. G. Bruty who retired in rotation being re-elected. Messrs. P. V. Hunter, A. H. Dykes and W. R. Rawlings were re-elected chairman, vice-chairman and hon. treasurer respectively. A donation of £10 was voted to the I.E.E. Benevolent Fund.

### Executive Committee's Report

The accounts for the year ended December 31st last show a total income of £3,686 (as compared with £4,327 in 1939) and an expenditure of £3,747 (against £4,099), resulting in an adverse balance of £61, as compared with a surplus of £228. The receipts from the issue and renewal of certificates declined by about £600. The Register's invested funds stand at £7,609 nominal with a market value as at December 31st of £7,710.

Up to January 3rd last twenty-two new certificates had been issued during the period; during 1939 the number was seventy-five. Of twenty-two applications for registration received in the course of the year thirteen were accepted, one was declined, one withdrawn and seven were under investigation at the close of the year under review.

Since 1924, when the Register commenced operations, up to January 3rd last 3,667 applications have been received, of which 711 were declined and 174 withdrawn. The number of registrations cancelled for various reasons (mainly death, closing-down of businesses, failures and non-renewal of registration) has been 2,156, leaving a net number on the Register at January 3rd of 1,811, a decrease of 185 during the year. The effect of war conditions is indicated by the figure of cancellations during the past year (207). At the last meeting of the Executive Committee (April 4th) a further decline to 1,491 was reported in the net number of contractors on the Register.

During 1940 the Register's inspectors made 497 visits and inspected about 1,500 installations of all descriptions. The results of these visits are summarised as follows:—Work satisfactory, no action called for, 87; minor faults, 243; undertakings given and explanations accepted, 99; new applicants inspected, 27; struck off Register following inspection, 2; no inspection of work possible owing to war conditions, 39.

Recent inspections disclose that in a number of cases registered contractors have little work in progress. It has also been found that some contractors' premises have sustained damage through enemy action and others have had to take other premises at short notice. In a few cases the new premises do not comply strictly with the minimum requirements of the Register; in such cases the contractors are required to give an assurance that they will, as soon as possible, obtain premises that do comply with the requirements.

Evidence obtained from various parts of the country during the past twelve months indicates that electrical installation contractors do appear to value registration as such and, in spite of present difficulties, desire to retain their registration. The value of maintaining the Register in a flourishing condition will be apparent, says the report, having in mind the large amount of electrical contracting work to be carried out after the war.

The Executive Committee expresses its appreciation of the work of the Local Advisory Committees, and the Scrutinising, Inspection and Liaison Committees and tenders its thanks to the chairman and vice-chairman, who have continued to give their time ungrudgingly to the service of the Register despite the difficulties of war conditions.

# Proposed N.S.W. Commission

### Supply Undertakings' Objections

WE recently reported that a proposal had been made to establish a State Electricity Commission in New South Wales to control the generation and distribution of electricity. *The Electrical and Radio Merchandiser* (Sydney) says that the proposal has met with considerable opposition from local government bodies and supply undertakings.

The Government proposed that the Commission should have power to co-ordinate electricity supply in metropolitan districts, suggesting that it should own a network of transmission lines, and possibly the major generating stations within the State. By a large majority, the State Electricity Advisory Committee has rejected the proposal, suggesting, as a more flexible, less costly and useful alternative, the establishment of a co-ordination committee or board, with powers to regulate development of the main power stations in the State, without owning them.

The Advisory Committee favours establishment of a board of management, comprising chief technical officers of the Sydney County Council, the Railways, the Local Government Department, and the Balmain Company, thereby giving representation to the undertakings producing 95 per cent. of the State's electricity. In the case of the board failing to reach agreement, it is suggested that an independent final arbiter should be consulted.

# Uses of X-Rays in Industry

## *Examination of Metal Structure and Fault Detection*

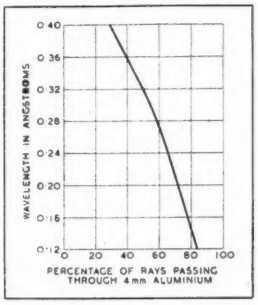
*For industrial purposes much higher peak voltages are required than for medical X-rays. Apparatus operating up to as much as 1,000 kV has been constructed for metallographic work*

**By T. Thorne Baker, F.Inst.P., A.M.I.E.E.**

BECAUSE very "soft" rays were totally absorbed by delicate material, such as cellulose, and anything of the nature of metal was regarded as opaque, the possibilities of diagnosing faults in metallic specimens was not envisaged until more powerful, higher-voltage generators were built, and the perfection of the construction of X-ray tubes to produce shorter wave-lengths of greater penetrative power.

The X-ray examination of wood for aeroplane construction, and of welds, became frequent practice during the last war, and considerable use of the rays was made in metallurgy. In 1938 the Air Ministry made compulsory routine X-ray examination of many aircraft parts. An example of the wholesale scale of X-ray testing was the 159,000 separate radiographs that were taken of 75 miles of steel welds up to 3 in. in thickness in the construction of the famous Boulder Dam.

To-day the use of X-rays in engineering and industrial work must be considered from two aspects. In pure radiography photographs can reveal such defects in castings as gas cavities, sand and slag inclusions, porosity, cracks and metal segregation ; others assist accurate diagnosis of welded parts and afford an excellent indication of the homogeneity and character of alloys. Straightforward radiography will show the distribution of ash, its type and aggregation in coal samples and will, indeed, indicate quantitatively the ash content within 1 per cent. In munitions work, the filling of shells and grenades can be checked, and so on.



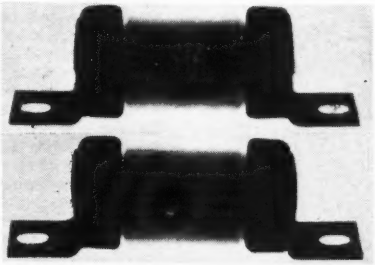

**Relationship between penetration and wave-length and absorption for 4 mm. of aluminium**

Another aspect of industrial application, which is rapidly gaining in importance, is analysis of the crystal structure of metals. In this the diffraction of rays from the planes of atoms according as they are arranged in the metal structure are recorded photographically. These diffraction photographs can be interpreted with such accuracy as to make them highly informative.

The strain release resulting from heat treatment, the effectiveness of case hardening, the effects of rolling on crystal structure and on grain size caused by mechanical treatment, are a few of the types of examination which can be made. This newer field of crystal analysis provides information for the metallurgist or industrial chemist of the molecular state of affairs, the diffraction photographs taken with modern equipment having been correlated on a wide scale with physical and chemical characteristics.

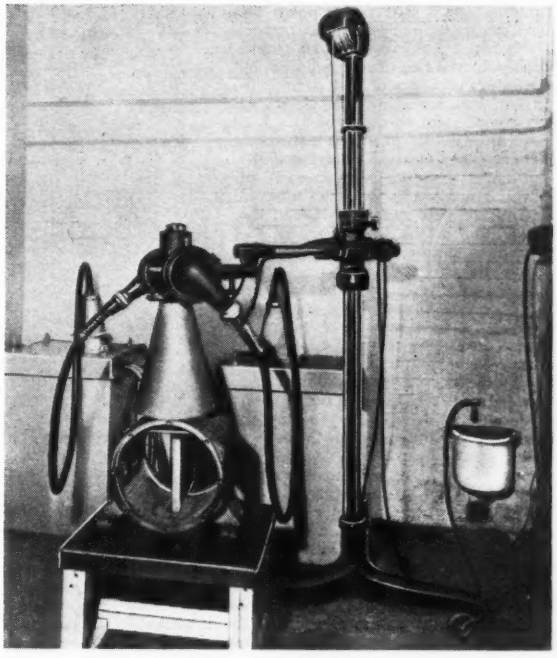
X-rays are electromagnetic radiations of the same type as visible light, but whereas there is barely an octave of wave-lengths in the visible range (390 to 770m$\mu$), there are fourteen octaves of X-rays (0.006 to 101.9 m$\mu$) which are detectable by photography, phosphorescence, chemical action, ionisation, photo-electric effect and diffraction by crystals.

In metallographic work, the wave-length of the rays limits the thickness of material that can be penetrated; the wave-length is controlled by the peak voltage of the discharge through the X-ray tube. Medical diagnostic radiography is done mostly at a peak voltage of between 45 and 120 kV. In metallographic work it may be as high as 250 kV; with some of the more recent equipment 400 kV has been employed, and apparatus working up to 1,000 kV has been constructed for special work.



**High-rupturing capacity fuse before and (above) after blowing**

While rays are absorbed nearly according to the customary exponential law, the actual relationship between penetration and wave-length is $I = Ie_o^{-\mu/\rho \cdot x\rho}$ where $I_o$ is the initial intensity of the rays and I their intensity after passing through the material of thickness $x$, while $\rho$ is the density of the material and $\mu/\rho$ its mass-absorption co-efficient. The tube voltage and hence the penetrative power of the rays is conveniently controlled by the modern electron type of tube, which is exhausted to about one millionth of an atmosphere, and regulated by the electron emission from a hot wire cathode excited from an independent source of energy. Coolidge and Philips tubes have been developed for radiometallography which operate at 250,000 V with 10 kW of energy.



**Watson-Marryat 140-kV industrial equipment for examining motor shell castings**

Something akin to the morphological revolution in wireless equipment applied to modern X-ray plant. Oil-immersed high-voltage transformers of a very compact type have been evolved, and metal tubes have in many cases replaced glass ones which themselves have been immensely improved in design. A large number of tubes are now being made in the Finchley factory of Newton & Wright, Ltd., of robust design and are standing up well to heavy outputs and continuous usage.

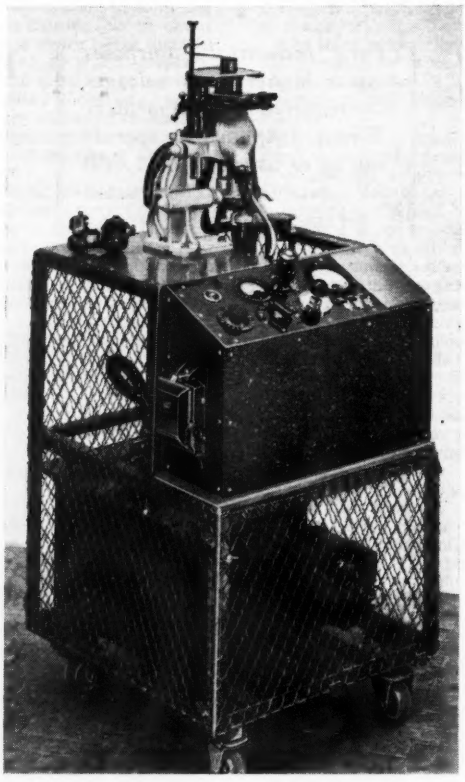
In the Watson-Marryat industrial equipment the tube is oil-immersed under vacuum and can thereby be made of very reduced dimensions. The main and filament transformers are contained in the same housing as the valves, the whole being oil-immersed. Valve rectification so reduces the stresses on the tube and cables that the apparatus will stand up to long exposures under heavy load. An important feature of the apparatus is the application of shockproof cables to the tube terminals so that the centre of the tube can be independently rotated. The 140-kV equipment illustrating the radiographic examination of a motor shell casting has a tube that is cooled by water supplied direct from the mains.

Much apparatus has been made sufficiently portable to bring it to the object to be radiographed rather then *vice versa* as was formerly necessary. Other apparatus, such as the "Perspectrosphere," has been designed for the specific purpose of routine inspection. The B.I. outfit made by the same firm (Siemens - Schuckert (Great Britain), Ltd.) is designed for the inspection of smaller steel and brass and gunmetal castings and welded structures. The tube is mounted on a heavy vertical stand, on the base of which is placed the specimen, on top of the photographic film. The equipment is shockproof and rayproof, and is rated at 140 kV.

The particularly fine work of the General Electric Laboratories has been done mostly with a sheet of lead (about 0.1 mm. thick) in contact with the photographic film during exposure. The secondary radiation from such an "intensifying" screen cuts down the necessary exposure by one half or more. The beam of rays from the tube itself is usually filtered free of soft radiation by a window of copper, lead or molybdenum, this increasing the clarity of the image quite considerably.

As an example of visual inspection there is apparatus (designed by Philips) for routine examination of objects going slowly past the tube on a conveyor belt running between the X-ray tube in the lower part of the cabinet and an upper fluorescent screen, the image on the latter being reflected at 90 deg. outwards towards the observer, who is thus effectively screened from the rays.

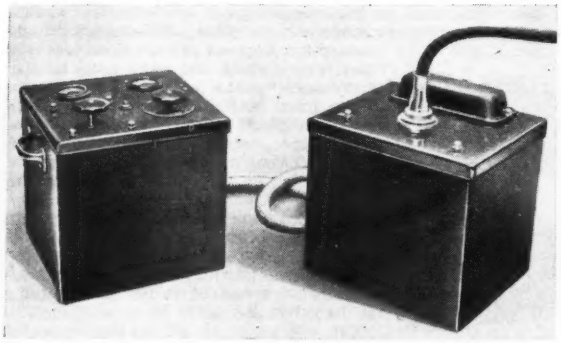
In considering protection it has always to be borne in mind that the effect of exposure is cumulative, and that harmful results may not appear for months or even years. Ventilation is almost equally important where a deal of routine work is to be done, to prevent the possibility of the operators' contracting pernicious anaemia.



**Hilger diffraction radiology outfit**

Apart from photography which is indicative of mechanical structure, an entirely separate sphere is the determination of the crystalline structure of metals, alloys, and many substances which had until fairly recently been regarded as non-crystalline. Owing to their small wave-length, X-rays are able to penetrate the relatively coarse matrix of a substance, where they are diffracted by the planes of atoms that compose it, and the diffracted or reflected rays can be registered on a photographic plate. Patterns are reproduced in the photograph which are characteristic for each metal, for every alloy, according to its physical condition. The method does not involve preparation and cannot therefore in any way damage the object being examined.

Any heat, or mechanical or chemical treatment to which a metal is subjected will cause some modification of the atomic arrangement and hence the "pattern" which is recorded in the crystal structure



**"Solus" shockproof transformer for X-ray crystal photography apparatus**

photograph with considerable accuracy, in a surprisingly short time. For this work Adam Hilger, Ltd., made a praiseworthy innovation by first designing and building a basis camera equipment to fulfil a number of metallurgical ideals and then constructing an X-ray tube specifically to suit it. Until the outbreak of war the majority of tubes used or this work were made in Holland and the United States.

The equipment, made entirely in this country, is housed in a compact portable trolley on castors. The camera and tube, ordinarily used in a vertical position, can be turned over to any angle up to horizontal and brought up against any large metal specimen, which can thus be examined where it stands in the factory. The tube is made wholly of metal, with the exception of the cathode mount; to protect the user from shock the body of the tube is kept at earth potential. The tube is kept exhausted by an oil diffusion pump backed up by a "rotaryoil" pump. A multiple target, which is inserted into the tube through a ground cone joint, has four faces of copper, cobalt, chromium and silver respectively, and can be rotated through angles of 90 deg. so that different radiation may be brought into use. This change can be made without losing the vacuum.

In the normal position the rays travel vertically upward from the target through a thin metallic window sealed to a frame on which is pivoted a disc carrying the necessary filter. Different types of camera, such as the flat-film type for the back reflection and transmission methods of analysis, the cylindrical type, or the combined Debye - Scherrer Seeman - Bohlin camera, can be readily slid into position.

Examples of crystal pattern photographs taken by the back reflection method show the effects of various treatments on the crystal structure of copper and differentiate between rolled and annealed aluminium foil. The operation of the outfit has been made so practical that no physicist is needed to operate it. What the makers stress is the need for *metallurgists* to study X-ray procedure sufficiently to be in a position to interpret readily the results and correlate atomic orientation with metallurgical properties.

A number of firms are already making excellent use of the technique, and a crystal analysis outfit may eventually be regarded as indispensable to the engineer and metallurgist as the microscope. The two together greatly expand the present scope of investigation and works control.

A compact transformer for crystal analysis apparatus is made by the Solus Electrical Co., entirely shockproof, to give 30 to 50 kVp to earth and 30 mA. It is made in two sizes for operating a single or two tubes, suitably "soft," such as the all-metal type designed by Philips and others for the work.

## Electricity Supply as "Essential Work"

THE National Service Committee for the Electricity Supply Industry consisting of representatives of both sides of the National Joint Board and National Joint Industrial Council, which is the only organisation representative of both the employers and the employees in the industry, has maintained contact with the Government on all matters relating to reserved occupations and kindred matters. The Committee was called into consultation with the Electricity Commissioners and Ministry of Transport on April 24th, when the chairman, Alderman W. Walker, put the case for the comprehensive certification of the industry as a whole under the Essential Work Order.

Alderman Walker submitted that the electricity supply industry fulfilled the requirements of the Order and to avoid duplication of applications it was most desirable that the Minister should deal with the industry as a whole and issue certificates to all undertakings. The terms and conditions of employment about which the Minister of Labour had to be satisfied were well known and were set out in long established agreements relating both to staff and manual workers. There would therefore be no difficulty arising under this head.

A general discussion followed and the Committee answered various questions put by the Commissioners and the representative of the Ministry of Transport, and there is every reason to believe that in the very near future the industry as a whole will be certified as engaged on essential work.

# Electricity in Collieries

## *Amendments to the General Regulations*

TWO years ago, as a result of recommendations made by the Royal Commission on Safety in Mines, a Committee was set up under the chairmanship of the late Professor W. Cramp to consider desirable amendments in the Regulations governing the use of electricity in coal mines. This Committee, over which Professor W. M. Thornton has presided from an early stage in its proceedings and of which Mr. J. A. B. Horsley, late Electrical Inspector of Mines, is a member, has now issued its Report (Stationery Office, 1s. net).

The Committee discusses the reasons underlying its proposals, which form the basis of new draft Regulations which are presented in an appendix. On the assumption that effect will be given to recommendations of the Royal Commission regarding certification of colliery electricians, it is provided that the latter shall have responsibility for installation, maintenance and testing of all electrical apparatus and cables, the use of which, if defective, they may stop immediately.

Definite standards of ventilation govern the introduction and continued use of electricity. Except for shot firing and communications, electrical apparatus used within 300 yd. of the coal face, or elsewhere where the gas content exceeds 0.5 per cent., must be of a type approved by the Board of Trade. The opening of any flame-proof enclosure that would expose live parts is forbidden in places where such construction is required. The view is expressed by the Committee that official certificates as to flame-proof enclosure issued after test should be reviewed every five years.

Sparking in 30-V remote-control and inter-lock and bell circuits must be avoided by the " intrinsic safety " method of shunting inductive components by condensers No earthed concentric system may be used in " safety-lamp " mines. Transformers (*e.g.*, of 50-kVA and above) and other apparatus containing in the aggregate 50 gal. and upwards of inflammable oil at one place should not as a rule be installed within 300 yd. of the face. It is suggested that the substitution of non-ignitable fluid, possessing also extinctive properties, might receive official approval as an alternative to flame-proof enclosure. In any mine where apparatus containing 50 gal. or more of inflammable oil is used, automatic fire extinguishing appliances or a sump to entrap escaping oil has to be provided.

*Towards the end of last year Mr. J. A. B. Horsley reviewed the position with regard to mining electrical regulations and indicated what amendments had proved to be necessary. This report sets out new draft regulations on these lines*

Equipment should be constructed to a standard not lower than that prescribed in British Standard Specifications and the Board of Trade should have power to make this requirement retrospective in dangerous instances, subject to right of appeal to arbitration.

Overhead lines (including those in existence) upon colliery premises are to comply with the Overhead Lines Regulations of the Electricity Commissioners. Instead of a minimum cross-sectional area of earthing conductor in such cases, a breaking load of 816 lb. for spans exceeding 150 ft. or for voltages exceeding 250 is prescribed, otherwise the figure is 330 lb.

Permission to employ 0.01 sq. in. earthing conductors in all flexible cables up to 650 V, however (instead of the previous minimum of 0.022 sq. in.) gives general sanction to a practice for which special exemption was formerly obtained. On AC systems exceeding 125 V it is proposed that flexible cables shall be of the screened type with an earthing core; the screen should not be used as an earthing conductor. When used with portable apparatus, the earthing core must be of the same size as the power cores. Leakage protection is to be compulsory for all AC circuits at more than 125 V. Flexible cables at the coal face are to be of a type officially approved as a result of tests of endurance and safety in respect of shock, fire and explosion.

### Cable Armouring Conductance

Chiefly from mechanical considerations, it has not been found feasible to reduce the conductance of the armouring of pliable cables below the 50 per cent. called for with armoured cables generally. It is, however, suggested that in the appropriate B.S.S. permissible limits for the lay ratio of the armouring in relation to pitch diameter should be prescribed.

Voltage limits are applied to a much greater extent than before. For portable motors of less than 5 HP, the maxima suggested are 250 V for DC and 125 V for AC; for larger motors it will be 650 V and, for motors of 50 HP and over above ground, 3,300 V. For fixed motors of less than 50 HP, 650 V is the limit proposed; above that output, but less than 250 HP, the figure is 3,300 V.

In lighting, there should be a general limit in the case of portable lamps of 250 V with 25 V for AC where the user is not insulated from earth. With fixed and transportable lighting installations, 500 V may be used for DC except within 300 yd. of the coal face, where the limit is 125 V. There is a general limit of 250 V for AC with a special limit of 125 V below ground and also above ground where the user is not insulated from earth or protected from shock.

Electrical interlocking should be made compulsory (except in earth-free situations where the voltage does not exceed 250) on AC circuits above 125 V where a plug and socket coupling, other than a bolted coupling, is used to connect a flexible cable to transportable or portable apparatus. Isolation without earthing of a circuit may be allowed on branch circuits not exceeding 650 V, where visible isolation is not provided on the switchgear, subject to the introduction in the relevant B.S.S. of an exacting type test to establish the mechanical endurance of the design.

In connection with motor control, means should be introduced to prevent accidental restarting after interruption of current, to stop the motor or machinery where the starting switch is not readily accessible to the operator and to stop in emergency any motor that is normally remote-controlled. An emergency switch for stopping haulage motors is proposed.

One section of the Report covers the installation and maintenance of plant. It is here pointed out that there must be a sufficient volume of air circulating to permit apparatus to be worked at full rating; otherwise the load must be reduced. A new regulation is proposed under which cables and apparatus are to be worked so as not to exceed the designed temperature.

Greater precision is given to requirements with regard to the installation of armoured cable, especially the protection of cables and joint boxes from mechanical injury. The Committee considers that a cable should not normally be buried in a mine roadway. Where it is, in exceptional cases, it should be enclosed in a substantial duct or culvert. Cold-pouring compounds are mentioned as offering a satisfactory means of sealing cable ends and junctions in mines where ordinary compounds cannot be melted on the spot.

As the delay involved in waiting for replacements of damaged flexible cables is often responsible for their continuance in use, a proposed new regulation requires that spare lengths, ready for immediate use, shall be held available in the mine equivalent to at least 25 per cent. of the number in use at working faces.

An addition to the existing requirement that all earthing shall be done at the surface of the mine is the provision that the resistance between an earth electrode and the general mass of earth shall not exceed two ohms. For certain purposes in the repair or installation of electrical plant, *e.g.*, large motors, there is no satisfactory substitute for a soldered joint. It is suggested, therefore, that electrically heated soldering bits and metal pots should be permitted in mines at voltages not exceeding 25 V.

An appendix tabulating the number of persons involved in accidents due to shock, fire and explosions each year from 1919 to 1933 gives an annual average of 22.45 fatalities and 60.25 non-fatal injuries from all causes.

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## Women in Industry

A STATEMENT issued by the Ministry of Labour & National Service says that the employment of women on certain processes in the engineering industry, particularly on capstans, milling and drilling machines and on inspection and light assembly work is now very common. In a number of engineering works, however, women have been used over a much wider field than this. One firm manufacturing aircraft engines is employing women operators on Heald internal grinders on which the sleeve valves of aero-engines (approximately 5½ in. in diameter bore and 14 in. long) are internally ground to a tolerance of 2/10th of a 1,000th of an inch. In one firm in the North-West women may be found welding steel fabricated plate in thicknesses of ¼ in. to 1½ in. In another large works in the same area they are boring tubes of 17 in. to 20 in. diameter, up to 48 in. long.

Instrument making is an industry in which women have been used for some time. One large firm employs women on optical grinding and polishing to extremely fine limits, and on general machine shop work. It is found that after three months' experience the women are able to work to drawings and to set up their own jobs, even for such work as cutting double square threads. A London firm of instrument makers is employing women on grinding, including pivoting, external grinding and gear hobbing on Mikron machines.

# INSTITUTION PROCEEDINGS

## *Lightning Protective Devices. Rapid Welding Development.*

## Protection against Lightning

THE protection of high-voltage transmission lines and plant connected thereto against the effects of lightning strokes was discussed in a paper by Mr. R. C. Cuffe, which was presented to the Irish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS in Trinity College, Dublin, on April 17th.

The author commenced by outlining theories at present held concerning the nature of lightning flashes before summarising some conclusions drawn from field tests in the United States, and elsewhere, about the currents and voltages (and their rates of rise) that might be anticipated on overhead power lines when they are struck by lightning. In discussing insulation characteristics, special reference was made to the time factor in relation to flash-overs and the influence it had on insulation co-ordination schemes.

In outlining the functions of differing kinds of protective devices the author observed that, in addition to screening the conductors, a further beneficial effect derived from an earthed overhead wire was the coupling between it and the phase conductors, which caused transients travelling along the latter to be more rapidly attenuated. The cost of equipping transmission lines throughout with a top protective wire was not warranted in every instance. Opinion was divided about the length of line which should be so guarded; an average length would be 1.24 miles. The chief effect of buried counterpoise wires attached to the bottom of steel masts appeared to be reduction of the footing resistance due to increased area of contact with the earth.

### Function of Control Gap

The rod gap was not considered to be effective as a primary form of protection for transformers and other station plant, but when properly adjusted might possibly afford a species of back-up protection against over-voltages. The so-called control gap was intended to combine the properties of a rod gap with some of those of a sphere gap, whose almost uniform electrostatic field caused a very flat volt-time characteristic, which was suitable for the protection of transformer insulation. The purpose of this device was to deal with very large surges, such as those induced by heavy direct strokes to lines near a station, which it would shunt to earth, so helping to back-up other devices. The main advantage of protector tubes (fibrous) having external and internal arc paths was that they were self-extinguishing, acting as "safety valves" for the line but not suitable for guarding station plant.

Arrestors consisting essentially of series gaps with discharge resistances were of two kinds; the line type would not limit voltage to so low a value as the station type of equivalent rating. They could only dissipate large currents for a very limited time, so that at present it was still advisable to employ some of the other means referred to for limiting surges in order to assist the arrestors.

Economic rather than technical aspects governed the safe-guarding of high-voltage plant against lightning. When selecting types of protectors it was not sufficient to consider their critical impulse flashovers alone; the shapes of their volt-time characteristics must be compared with those of the apparatus it was proposed to protect. For guarding against steep-rising voltage transients the arrestor was the only device which the author considered capable of affording reasonable protection to solid insulation whose volt-time characteristic was flat.

A system's maximum operating voltage, phase to ground, determined the rating of the arrestors that could be applied to that particular system. Once an appropriate arrestor had been chosen, then a basic impulse insulation level should be established; that decision would be largely economic, since the level could be (*a*) sufficiently high to withstand all overstresses, except some approximately determinable small percentage of anticipated surges, or (*b*) somewhat less if auxiliary limiting devices were provided to assist the arrestors.

## The Importance of Welding

IN proposing the toast "The Guests" at last week's luncheon of the INSTITUTE OF WELDING, Sir William J. Larke (president), said that the function had brought together many distinguished guests who were directing the national effort in the field of productive activity, producing the material and equipment without which our fighting forces would be powerless. In conjunction with members of the Institute, they would endeavour to increase the value of the contribution which welding could make to economy in the use of material and labour. It had already been proved in many of the fields of activity for which they were responsible that an economy as high as 75 per cent. in both material and labour was possible by the application of welding, where designs were suitable or modified to obtain the maximum advantage from its use. It would be obvious that such economy must result in a proportionate increase in the volume of production in a given time.

During the war period the industries' contributions to research funds had substantially increased, and the membership of the Institute during the same period had risen by 20 per cent. and was still increasing. He coupled the toast with the name of Dr. Gough, Director of Scientific Research, Ministry of Supply, to whom the Institute was particularly indebted.

Replying to the toast, Dr. H. J. Gough referred to the Institute's valuable work, and said that the comprehensive work of the Welding Research Council, so ably directed by Sir William Larke, had been most fruitful, with some particularly valuable results.

From an extensive research on the weldability of high-tensile steels, practical rules had been provided for the welding of such steels, while a medium high-tensile steel of good weldability had been developed and the production of weldable steels of higher strength was in progress. Much knowledge had been gained of the factors involved in the welding of non-ferrous metals and a study on the strength and consistency of spot welds in light aluminium alloy gave promise of the successful extension of spot welding in aircraft construction.

Useful application was already being made of two years' investigation into the strength of welded ship structures: full-scale sections of bulkheads and shell framing were used in this research. Research into the butt-welding of tubes for high-pressure steam piping had provided a solution to a serious problem, especially useful at a time when so many factories were being equipped.

Investigations into the strength and behaviour of steel frameworks having rigid joints had shown that their load-carrying capacity exceeded by as much as 30 per cent. that of a similar structure with flexible joints. Such a rigid frame, or even one possessing continuity in the framework, would resist the effects of blast where a structure built to ordinary design would collapse.

### The Training of Welders

Welding was certainly employed very widely in this country at the present time; about 150,000 welders were available. Yet, if we considered only those applications for which welded construction had been proved to be satisfactory and economical, only 15 per cent. of the work was actually welded. Welding operatives could be easily trained and the Ministry of Labour had reorganised its scheme of training welders on lines suggested by the Institute of Welding, making it possible to produce a greater number of welders to a standard of training in accordance with the needs of the present time.

There were several important developments and factors which deserved close watching so that still further economies might be effected. In the field of ship-building it had been shown that a saving in weight of as much as 10 to 20 per cent. could be effected by fabricated construction. A remarkable advance in technique had been made practicable the welding of armour-plate in all the thicknesses required for fighting vehicles. Turning to production in general, every effort should be made to relieve the machining capacity of the country by fabricating simple parts direct from bar stock. The Ministry of Supply had called for the help of the Institute and the collaboration of the industry in ensuring that welding should be used to the best advantage in the war effort. The Minister had set up an Advisory Service on Welding, staffed by specialists in the different aspects of welding and welding practice.

## Forthcoming I.E.E. Meetings

THE times of the May meetings of the INSTITUTION OF ELECTRICAL ENGINEERS have been changed. On May 8th at 2.30 p.m. the President will, at the request of the Engineering Institution of Canada, present the Sir John Kennedy Medal, which is awarded "for contributions to the advancement of engineering science," to Lieut.-General A. G. L. McNaughton, commander of the Canadian Forces in Great Britain.

The 1941 Faraday Medal will be presented to Dr. A. P. M. Fleming, and the Coopers Hill War Memorial Prize and Medal (1940 triennial award) to Mr. John S. Forrest for a paper submitted by him. Next the annual Kelvin Lecture, which will deal with "Electrical Works by Helios, or the Sun and the Ionosphere," will be delivered by Dr. S. Chapman, professor of mathematics at the Imperial College of Science and Technology.

Subsequently, at 3.45 p.m., the I.E.E. annual general business meeting will take place and be followed at 4.30 p.m. by the annual general meeting of the I.E.E. Benevolent Fund. Copies of the annual report for 1940-41 and of the accounts for the year ended December 31st, 1940, can now be obtained by members of the Institution on application to the Secretary.

# COMMERCIAL and INDUSTRIAL NEWS

## *London Gas-Electricity Agreement. Purchase Tax Returns.*

### The "Truce" in London

IN our issue of April 4th we set out the terms of an agreement which had been arrived at between London gas and electricity undertakings with regard to publicity and other matters. We now learn from Mr. V. W. Dale, of E.D.A., who, with Mr. L. H. Hardern, of the London Regional Gas Centre, is joint secretary of the Greater London Gas and Electricity Committee, that the proposals have been adopted by eight gas undertakings in the London Regional Gas Centre, and forty-seven electricity undertakings in the Greater London area of the British Electrical Development Association.

The proposals implement the January, 1940, report and recommendations of the National Joint Gas and Electricity Committee. It is claimed that the procedure does not interfere with fundamental trading practice; it is designed to avoid, as far as possible, any action that might, even in a small degree, prove a hindrance to the nation's effort at the present time.

At the last meeting of the Committee it was agreed to extend the area to cover the whole of the "London Region" comprising fifteen gas undertakings and sixty-two electricity undertakings. Steps are now being taken to secure acceptance of the procedure by the additional authorities.

### Concentration of Industry

In the House of Lords last week Lord Barnby raised the subject of industrial concentration and asked whether the Government could indicate what procedure was contemplated to achieve the necessary co-ordination between the Departments concerned and to safeguard the future of individual firms.

Lord Gainford said that employers felt that they had not been sufficiently consulted in connection with some of the Orders issued and suggested that in future their experience should be made use of.

Lord Portal, replying for the Government, said that there had been a great deal of co-ordination between the Ministries concerned. So far all the industries affected had been approached through the Federation of British Industries and had been asked to formulate their own schemes. The Government fully appreciated the importance of retaining goodwill and trade marks.

### Transport Officers to Assist Exporters

Transport and progressing officers have now been appointed to most Area Boards by the Board of Trade. In each of the Civil Defence Areas there is a Board of Trade representative on the Area Board, one of whose main duties is to assist exporters to overcome difficulties encountered in the course of their business. Transport has offered particular difficulty and Board of Trade Transport and Progressing Officers have therefore been appointed to assist the Board of Trade representative. Exporters are urged to take full advantage of the services which these officers are able to give.

### Costing of Government Contracts

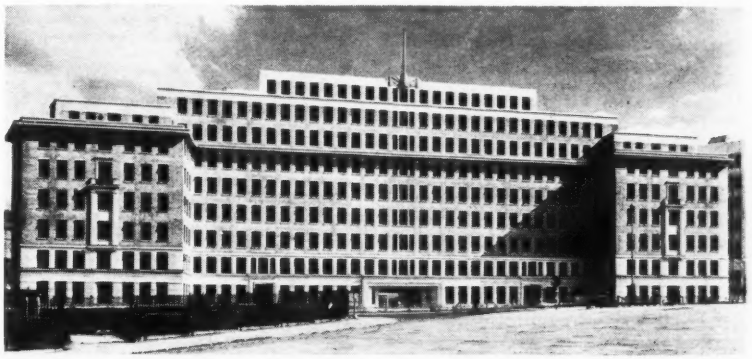
At a meeting arranged by the Engineering Industries Association last week a most helpful address on the subject of the costing of Government contracts was given by Mr. S. J. Noel-Brown, president of the Society of Cost Accountants. Representatives from engineering concerns from many parts of the country were present.

### Artificial Daylight

The performance of lighting fittings for colour matching can be specified only in relation to some standard with respect to which tolerances may be expressed. Standard illuminant "C" has accordingly been chosen as the source for the purpose of the new B.S.950. It is one of the two principal standards designated by the International Commission on Illumination for colorimetric measurement and is representative of the average north skylight in Great Britain. The two requirements to be satisfied are that the light output of artificial sources for colour matching shall be within certain limits in respect of both colour and the difference between the spectral energy distributions of the fitting and the standard with which it is compared. For the latter determination by an approximate filter method filters are defined with considerable care in an appendix Copies of the new specification are obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 3d. post free.

### A Thames-side Installation

Interesting electrical work is a feature of the new office block, Lambeth Bridge House, on the Albert Embankment overlooking the Thames. This imposing building consists of the ground and eight upper floors, with a basement designed principally to provide air raid shelter accommodation. The basement is framed in reinforced concrete and the upper floors are steel framed. The main



**The new Lambeth Bridge House has a very complete electrical installation**

roofs are covered with three-ply bituminous waterproofed roofing and a 2-in. layer of insulated pumice concrete and all floors are finished with oak blocks.

Supply is taken from the South London Electric Supply Corporation, Ltd., h.v. mains being brought into a substation in the building, and transformed to 400/230 V, 3-phase, 50-cycles. A 1,000-A triple-pole oil-immersed circuit-breaker controls a four-pole busbar chamber, from the bars of which three 0.3 sq. in. four-core p.i.l.c. and s.w.a. cables are run to 300-A triple-pole and neutral main switches with h.r.c. fuses, which control three sets of rising mains, each consisting of four 1¼-in. by ¼-in. copper bars mounted in steel trunking, running from the ground floor to the top floor. The bars are drilled and tapped and fitted with cable lugs at each floor to facilitate connections and the balancing of the load on phases by interchanging connections.

For the power circuit, separate feeders controlled by 200-A t.p. and neutral switch-fuses are run to a three-way, 100-A fuseway, t.p. and neutral distribution board, to which are connected five 21-HP lift motors, boiler house motors and ventilating plant for lavatories and air raid shelters.

The installation includes 2,640 lighting points and 160 3-kW heating points. Approximately 95,000 ft. of conduit and 120,000 yd. of Henley cable have been used in this installation, which was carried out by the Berkeley Electrical Engineering Company, Ltd., to the instructions of the architects, Howard & Souster, F.R.I.B.A., F.S.I.

### Met-Vick War Efforts

The Metropolitan-Vickers Electrical Co., Ltd., is subscribing a sum of £25,000 to Stretford's War Weapons Week. A like amount was subscribed by the company to Manchester's War Weapons Week last year.

The employees of the company (assisted by a donation from the company) have subscribed £5,000 for the purchase of a Spitfire.

The amount subscribed to March 31st to National War Savings by the employees was £33,656. This figure is made up of a large number of weekly subscriptions.

### Export Catalogue for Plastics

An 88-page export catalogue of British products moulded in plastic materials has just been published by the Plastics Export Group, 11–12, Pall Mall, London, S.W. 1, in English, French, Spanish and Portuguese. The publication is very comprehensive and as Sir Andrew Duncan, the President of the Board of Trade, points out in an introduction, the loose-leaf form of the catalogue has been chosen to simplify the inevitable additions and revisions. Mouldings for electrical purposes are well represented and among the numerous excellent illustrations are pictures of cases for meters, resistances, fans, hair dryers, and radio sets; electric fires; knobs and dials of various kinds; vacuum cleaner parts; electrical accessories, etc. Concise details of each individual item are given wherever possible, usually with dimensions, and there is a good index, as well as a list of the forty-five members and their addresses.

In order to avoid competition amongst members' agents, the Group has appointed, in conference with the Department of Overseas Trade, joint agents and sub-agents who will act in their respective territories throughout the world as representatives of all the members. Each of these agents is being provided with considerable numbers of the catalogues, together with samples of the mouldings illustrated. Minimum export selling prices have also been agreed amongst members in order to eliminate competition.

### Cartridge Fuse Construction

Thirteen years ago short break cartridge fuses were introduced by W. T. Henley's Telegraph Works Co., Ltd., for the protection of distribution circuits, particularly in underground disconnecting boxes and overground pillars. Though there has been little change in their external appearance, modifications of internal construction have altered their performance in conformity with increasingly exacting service requirements. Of value in helping to select correct fuses for particular duties are a booklet (WF) and separate catalogue (WF.1) which contain technical details of constructional features and performance tests of many kinds carried out in England, Holland and Belgium in accordance with the highest category of duty specified in B.S.88, namely, 440 AC4 (33,000 A at 440 V) representing a rupturing capacity of 25,000 kVA.

Bi-metal construction is not resorted to in the endeavour to permit the central fusible portion to function at higher temperatures without unduly heating the ends of the element. Instead the stems are made of expanded lattice form, so enlarging their superficial area as to dissipate more heat into the surrounding filling medium (silver sand). This

means of reducing the temperature of the circuit terminals is particularly advantageous whenever parts of the contacts are close to, or embedded in, insulating compounds. Also, the ends of the ceramic barrel are precision ground after firing to ensure good bedding for the spun-on-end caps, thus avoiding the need for securing cement, or risk of loosening of the junctions in exposed situations subject to adverse climatic influences.

## Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that the "cost-of-living" figure on April 1st (98 per cent. above the 1914 level) will involve an increase in wages on the third pay-day in May in respect of the period for which payment is made on that pay-day. The new rates are as follows :—Male timeworkers, 21 years of age and over : Varying from 68s. 6½d. to 76s. 4½d. in district No. 1, and from 62s. 6d. to 70s. 6d. in district No. 2. Youths and boys, under 21 years of age (timeworkers) ; Varying from 18s. 1½d. to 56s. 3½d. in district No. 1, and from 17s. 6d. to 53s. in district No. 2. Female timeworkers, districts Nos. 1 and 2 : Varying from 35s. 6d. to 39s. 6d. for women 18 years of age and over, and from 17s. 6d. to 22s. for girls under 18 years of age. The rates for female timeworkers do not include any service bonus that may be due.

## "Electrical Engineers' Companion"

A most useful compendium of facts and formulæ relating to bare and insulated wires and electric cables of all descriptions, together with general information about electrical, mechanical and hydraulic engineering is available (priced at 3s. 6d.) from the Publicity Department, London Electric Wire Co. and Smiths, Ltd., 19 Queen Anne's Gate, Westminster, London, S.W.1, or provincial branches. It is of vest pocket size for convenient reference, in a pliable leather binding, and in collecting and arranging the data the B.S.I., I.E.E. and E.R.A. rulings and ratings are fully recognised.

## Dominion and American Standards

At the present time it is perhaps even more important than in peacetime that British manufacturers should be familiar with the industrial standards adopted in the Dominions and in the U.S.A., just as engineers in those countries should be familiar with British Standards. Readers are reminded, therefore, that the standards issued by the official Standards Bodies in the Dominions and in the U.S.A. are regularly received by the British Standards Institution, and that copies can be obtained on application to 28, Victoria Street, London, S.W.1.

## Aid for Southwark Firms

In these days of heavy damage to business firms, caused by enemy action whereby offices and records are destroyed, firms find it hard to make even temporary arrangements for a day or two. The Southwark Borough Council recognising this has provided facilities at the Southwark Public Libraries and Cuming Museum whereby Southwark firms can have temporary accommodation until they have acquired fresh premises. This assistance has already proved of value. Firms have been able to reconstruct some of their records with the aid of the wide range of directories, covering the whole world, which are available. Posters are displayed all over the borough inviting firms to register their temporary addresses.

## Peruvian Electrical Imports

The *Board of Trade Journal* shows that the total value of "electrical materials" imported into Peru during 1940 was 12,399,000 soles as compared with 7,153,000 soles in 1939. (At par 17.38 soles=£1.)

## Southern Rhodesian Export Restrictions

The *Board of Trade Journal* reports that the Board of Trade has received a copy of Government Notice No. 103, dated 28 February, published in the "Government Gazette" of the same date, which contains an Order entitled Export (Machinery) Order, 1941. This Order prohibits the exportation from Southern Rhodesia, except with the written permission of the Controller of Supplies, of the following machinery :—Electric power generating machinery whether steam, gas, water or oil engine driven, together with associated prime movers, boilers, auxiliary plant and spare parts pertaining thereto; electrical driving machinery, control equipment, apparatus, electricity consuming devices, together with component parts and spares; material, device and apparatus employed in the transformation, transmission, distribution and consumption of electricity; mining machinery; ore reduction, dressing and treatment plant; machinery and apparatus for the recovery of precious and base metals; accessories and spare parts pertaining thereto; machine tools; accessories and spare parts pertaining thereto; industrial manufacturing plant; tools, dies, jigs, and accessories pertaining thereto.

## Meter Men's Remuneration

In the April issue of the *Electrical Trades Journal* (the organ of the E.T.U.) reference is made to a further effort which has been made to deal with the problem of men engaged in the meter departments of electricity supply undertakings.

At present, it is noted, the staffing is done under both the Joint Board Schedule and the various D.J.I.C. Schedules and the main difficulty is to find accommodation that will be satisfactory to all parties concerned. "In these schedules the meter mechanic has in most cases been regarded as the most important, and rates of pay fixed accordingly. It is contended to-day that the testing staffs have to deal with well over fifty different types of meter, and other apparatus, and much of the work is highly skilled. It will be necessary to have further meetings, after which it is hoped that we will be in a position to present joint proposals to the employers."

## Machinery and Plant Control

Under the Machinery, Plant and Appliances (Control) (No. 2) Order 1941 (S.R. & O. 1941 No. 516) which came into force on April 17th, 1941, the Machinery and Plant (Control) Order 1940 (S.R. & O. 1940 No. 875) is so amended as to permit the supply without licence of machinery, plant and appliances by "manufacturers" (who include reconditioners) provided that they carry out no act of "manufacture" thereon and that they have not acquired it from another "manufacturer." The schedules of the machinery, plant and Appliances to which the Orders relate are included in the Machinery and Plant (Control) (No. 2) Order, 1940 (S.R. & O. 1940 No. 1363) and the Machinery, Plant and Appliances (Control) Order, 1940 (S.R. & O. 1940 No. 2179). Copies of all the relevant Orders are obtainable from the Stationery Office, price 1d. Application forms for licences to acquire such machinery, plant and appliances may be obtained from the Industrial Supplies Department (Machinery Licences Division), Board of Trade, 1–6, Tavistock Square, London, W.C.1.

## Purchase Tax Returns

The Commissioners of Customs and Excise have decided that the current period for which Purchase Tax returns must be made shall be from March 1st to June 30th. Thereafter the periods will be July 1st to September 30th, October 1st to December 31st, January 1st to March 31st and April 1st to June 30th in every year. Returns must be furnished not later than the last day of the month following the expiration of the period in respect of which the return is due.

At the same time, the arrangements whereby tax on sales not paid for in each period may be carried forward to the next will be discontinued. In future, therefore, tax will be payable on all taxable transactions occurring within the period without deduction in respect of sales not paid for ; but the period of grace within which tax must be paid has been extended from ten days to a month. Any tax outstanding from previous periods must be included in full in the payment due in July next. The necessary forms (P.T.11) on which the statutory return of tax must be made will be posted to all registered persons at the close of the current period.

To meet the convenience of trade, the Commissioners will be prepared to accept returns made up to a date a week or two later than the end of the quarter, *e.g.*, July 15th instead of June 30th, where registered firms prefer to adopt such a course on account of their book-keeping arrangements. No extension of the dates by which the returns must be rendered and the tax paid to the collector can, however, be allowed for this or any other reason.

## Women in Supply Work

It is reported that the Manchester Corporation Electricity Department, in collaboration with the Ministry of Labour, has arranged to train thirty women a month for light mechanical work.

Women for meter reading, etc., are being asked for by the Walthamstow Electricity Department. The wages offered for a 47-hour week commence at £3 12s. and rise to £4 after six months' service.

## A.R.P. in Plating Shops

Air raid precautions that should be taken in electro-plating shops to minimise the consequences of contact between solid cyanides and liquid acids are set out in a pamphlet issued by the Ministry of Home Security. A suitable test for the poisonous gas evolved when these substances are mixed is described in "Methods for the Detection of Toxic Gases in Industry" (Leaflet No. 2 Hydrogen Cyanide Vapour) published by the Department of Scientific and Industrial Research. Both pamphlets, respectively priced at 1d. and 5s. 6d., are obtainable from H.M. Stationery Office, Kingsway, London, W.C.2.

## Limitation of Supplies

The Board of Trade has announced that for the quotas for the next restriction period under the Limitation of Supplies (Miscellaneous) Order, *i.e.*, June 1st to November 30th, 1941, the standard period on which the quotas will be based will be the same as for the first Miscellaneous Order, namely June 1st to November 30th, 1939.

## Trade Announcements

In order to quicken deliveries in the Eccles district Messrs. G. H. Graves, wholesale electrical factors, Manchester, have opened a branch at 248a, Liverpool Road, Patricroft.

The Manchester office of Macrome, Ltd., has been removed to 241, Deansgate, Manchester.

Superlamp, Ltd., is shortly opening a new branch at 25, Priory Street, Bedford.

## Changes of Address

The National Electrical Supplies Co., Ltd., has moved to temporary premises at 36, Chiltern Street, Baker Street, London, W.1 (telephone : Welbeck 8121). Manufacturers' catalogues, etc. would be welcomed.

Clarke, Chapman & Co., Ltd., have changed their temporary address to 29, Castlebar Road, Ealing, London, W.5 (telephone: Perivale 2254/5). All London office business will be dealt with from Ealing.

E. N. Mackley & Co., have removed to 29, Castlebar Road, Ealing, London, W.5 (telephone: Perivale 2254/5).

The Clyde Crane & Engineering Co., Jos. P. Booth & Bros., and the Leeds Engineering & Hydraulic Co., Ltd., have also removed to 29, Castlebar Road, Ealing, London, W.5.

## Calendar

Messrs. G. H. Graves have sent us a calendar with monthly sheets illustrated with views of London, picturesque rural scenes and animal studies.

## New Catalogues and Lists

**Rawlplug Co., Ltd.,** Rawlplug House, Cromwell Road, London, S.W.7.—The forty-second edition of the "Rawlplug Guaranteed Products" catalogue, which has been brought up to date and contains alterations in prices and details of various new lines.

**General Electric Co., Ltd.,** Magnet House, Kingsway, London, W.C.2.—Leaflet OS.9316, giving particulars of "Osira" fluorescent tubes and G.E.C. reflectors.

**Rotherham & Sons, Ltd.,** Coventry.—An illustrated leaflet dealing with specialised precision instruments.

# ELECTRICITY SUPPLY

## *Manchester Coal Supply Protest. Western Australian Regulations.*

**Ashton-under-Lyne.**—SWITCHGEAR ALTERATIONS.—The Town Council is to apply for sanction to borrow £20,641 for the modification of e.h.v. switchgear.

**Billingham-on-Tees.**—OVERHEAD LINE—The Urban District Council is not to oppose an application by the North-Eastern Electric Supply Co., Ltd., to erect an overhead line in the area.

**Darwen.**—SUPPLY AGREEMENT.—The Corporation Electricity Department has entered into an agreement with the Walpamur Co. for a supply of electricity.

**Felling-on-Tyne.**—OVERHEAD LINES.—The North-Eastern Electric Supply Co., Ltd., is applying for sanction to erect overhead lines. The Urban Council is not opposing the plan.

**Guildford.** — SUBSTATION. — The Rural District Council is to raise no objection to the proposal of the Mid-Southern Utility Co. to erect a substation.

**Heston and Isleworth.**—LOANS.—The Borough Council is recommended to make application for sanction to borrow £1,908 for proposed e.h.v. mains extensions, and £698 for h.v. supplies.

**Ilford.**—ELECTRICITY CHARGES.—The Corporation Electricity Committee has decided that the increase in electricity tariffs shall remain at 20 per cent. in respect of accounts for the second quarterly account period, 1941, with the exception of tariffs E and F which relate to power supply and which, in lieu of the present war increase will be subject to:—(*a*) 6 per cent. war increase; (*b*) adjustment under a coal clause of 0.001d. for each variation of 1d. per ton from 15s. per ton; and that the position as to the future be considered before the end of June.

EMERGENCY REPAIRS.—The Emergency Committee has decided to apply to the Electricity Commissioners for a code number to expedite the obtaining of materials for the repair of wiring in damaged premises.

**London.**—HACKNEY.—The Borough Council is applying for sanction to a loan of £1,500 for AC electricity meters. Sanction has been received to borrow £500 for the provision of vertical distributors.

PADDINGTON.—The Metropolitan Electric Supply Co., Ltd., has agreed to supply electricity for public air-raid shelters, wardens' posts and similar premises on a special contract tariff operating retrospectively from January 1st.

**Manchester.**—COAL SUPPLY PROTEST.—The *Manchester Evening News* reports that the Electricity Committee is to protest against the Mines Department's decision that it shall take South Wales Coal. According to a member of the Committee this will cost the Department much more than Lancashire coal for which the boiler plant is designed.

**Middlesbrough.**—CABLE WORK.—The Town Council has received sanction to borrow £2,450 in respect of interconnecting cable between two substations.

MOTORS FOR SCHOOL BOILERS.—The Education Committee has approved the expenditure of £230 on the installation of electric impeller motors for gas-fired boilers at schools at Beechwood, Brambles, and Whinney Banks.

**Oxford.**—LOAN SANCTIONED.—Sanction has been obtained by the Town Council to borrow £2,140 for electricity mains and equipment.

NEW SUBSTATION.—The Town Council has agreed to lease a site to the Wessex Electricity Co., for the erection of a substation.

**Rushden.**—SHELTER LIGHTING AND HEATING.—The Urban District Council is to install electric lighting and heating in the public semi-surface shelters.

**Scarborough.**—SUBSTATION ALTERATIONS.—The Town Council is to proceed with alterations and additions to a substation.

**Stoke-on-Trent.**—MAINS.—The Corporation Electricity Committee is to relay low-voltage distributors in Piccadilly, Hanley, at a cost of £900. Mains are to be extended at a cost of £50 to provide supply to Goldenhill Farm.

**Stretford.**—SHELTER INSTALLATIONS.—The Corporation has approved a scheme for lighting and heating air-raid shelters at an estimated cost of £3,700.

**Sunbury-on-Thames.** — LIGHTING OF SHELTERS.—The Urban District Council has received the approval of the County Council to proceed with the installation of electric lighting in air-raid shelters.

**Wallasey.**—INCREASED CHARGES.—The Electricity Committee has increased its charges by approximately 10 per cent. In future ordinary consumers will pay 3.6d. per kWh for the first 500 kWh; 3.3d. for 500 to 1,000; 3d. for 1,000 to 1,500; and 2.3d. for any in excess, subject to 5 per cent. cash discount. Fixed charges are also revised. The increases extend to heating and cooking, central heating services, electric vehicle charging, restricted hour lighting, etc.

**Walthamstow.**—DEARER ELECTRICITY.—The Borough Council has been recommended to increase the charges for electricity as from the end of the June quarter as follows: Scale A (general purpose lighting) from 3½d. per kWh to 4d. for the first 250 kWh and 3½d. per kWh for the remainder. Scale C (domestic rate), primary rate increased from 10 to 12½ per cent. per annum of the rateable value. Scale D (heating and cooking), from ¾d. to 1d. per kWh.

**Warrington.**—GRID STATION EXTENSIONS.—The Central Electricity Board is to carry out extensions to the grid station.

**West Hartlepool.**—LOAN APPLICATION.—Application is being made to the Electricity Commissioners by the Town Council for sanction to borrow £5,000 for extensions to mains and services, and £1,000 for consumers' wiring installations.

**Wood Green.**—INCREASED PUBLIC LIGHTING RATE.—Notification has been received by the Town Council from the Northmet Power Co. that an increase of 12½ per cent. is to be made in the charges for public lighting now in commission.

**York.**—LIGHTING OF ASSEMBLY ROOMS.—The Town Council is recommended to approve the installation of electric lighting at the Assembly Rooms at a cost of £284.

COAL-HANDLING PLANT.—The Council is contemplating the provision of coal storage and handling facilities at the generating station, at an estimated cost of £25,700.

### Overseas

**Australia.**—PERTH ELECTRICITY PROFIT.—The Perth Electric Light and Gas Department reports a profit made by the electricity branch during 1940 of £83,997.

WESTERN AUSTRALIAN REGULATIONS.—The Western Australian Minister for Works (Mr. Millington) recently said that there was evidence that the public generally was not sufficiently aware of the purport and scope of the Electricity Act of 1937, and the regulations made under the Act. The main purposes were the protection of users of electricity, and the improvement of the standard of electrical work. Regulations governed the licensing of electrical workers and cinematograph operators, safety precautions for persons working on overhead lines, and the approval of electrical materials. A definite move was also being made throughout the Commonwealth to obtain uniformity in the grading of electrical goods. All electrical workers, with the exception of linesmen, must now be licensed, including refrigerator mechanics, radio service men, and persons in retail establishments who fitted connectors to electrical appliances.

**Canada.**—OTTAWA COMMISSION'S INCREASED PROFIT.—The Ottawa Hydro-Electric Commission closed the year 1940 with a net surplus of $95,182.39. This compares with a $74,855.95 surplus for 1939. Revenue amounted to $960,237 and total expenditure to $717,119.

PROGRESS IN QUEBEC.—A steady increase in the number of consumers in the last three years is shown in the annual report of the Quebec Public Service Board, the total number connected being 495,432 in 1940, 479,022 in 1939, 469,906 in 1938, and 447,319 in 1937. Sales of electricity totalled 15,241.7 million kWh, representing a gross revenue of $59,385,202. The report covers the activities of 81 public service bodies licensed by the board. The highest increase (33 per cent.) was shown in farm use, the number of consumers rising from 17,762 in 1937 to 23,022 in 1940 The increase in rural supplies was slightly less (28 per cent.) with the number of consumers rising from 36,728 to 47,176. The total of urban consumers showed an increase of only 9 per cent. from 315,507 to 343,255, while industrial consumers actually dropped slightly from 11,830 to 10,632. The average urban consumption rose from 686 kWh in 1937 to 771 in 1940, the average cost per kWh falling from 2.81 cents. to 2.7 cents.

**Portugal.**—HYDRO-ELECTRIC SCHEME.—A scheme for hydro-electric development on the Rivers Tagus and Almega has been approved by the Minister for Public Works. The scheme is particularly intended to replace the necessity for importing foreign coal, of which Portugal takes over 1,000,000 tons a year. It is estimated that the power produced would be sufficient to meet all the needs in view.—*Reuter* (Lisbon).

**United States.**—LARGE WIND TURBINE.—A large wind turbine, designed to test the practicability of harnessing mountain winds as another source of commercial electric power, is nearing completion on a ridge in the Green Mountains, says *Reuter's Trade Service* from New York. With the erection of a 110-ft. steel tower and the installation of two 22-ton blades, engineers say that assembly will progress quickly and that the turbine may be ready for trial about June 1st. According to Mr. S. D. Dornbirer, superintendent of field erection for the S. Morgan Smith Co. of York, Pennsylvania, owner of the turbine, it is the only one of its size and kind in the United States. The station will have a capacity of 1,000 kW. When placed on the tower the blades will have a wing-spread of 800 ft., and the mechanism within the tower will be so arranged that the blades will yaw into the wind at all times. The rotating mass will exceed 75 tons, including the blades and other mechanism.

# TRANSPORT

**Great Britain.**—NEW PUBLIC SERVICE VEHICLE REGULATIONS.—The Minister of Transport has made new Public Service Vehicles (Conditions of Fitness) Regulations, 1941 (S.R. & O. 514 of 1941). These replace the 1936 Regulations.

**Russia.**—POWERFUL ELECTRIC LOCOMOTIVE.—According to the *Passenger Transport Journal*, the Dynamo Works in Moscow has designed an electric passenger locomotive of 4,000 kW capacity running at a speed of 112 MPH. The new locomotive, which is said to be the most powerful in Europe, is capable of pulling a passenger train of twenty-two carriages. The only electric locomotives of similar capacity are believed to be found in Switzerland, but the latter are used for freight trains only. The building of the first experimental locomotive of the new design has already been started.

**Southend-on-Sea.**—TRAM ABANDONMENT.—The Town Council is to proceed with the abandonment of the tram track.

**United States.**—DIESEL ELECTRIC GOODS LOCOMOTIVES.—Experiments with large new Diesel-electric locomotives for high-speed goods transport are now being carried out by the Santa Fe railway on the run from Los Angeles to Chicago. Two of these locomotives have been put into service, and if their operating cost is satisfactory they will replace steam locomotives generally.

On this transcontinental run, it is stated, the Diesel engine needed only five stops for fuel and water, whereas steam locomotives require thirty-six. Furthermore, unlike steam trains, the electric trains can pass over the various mountain grades without assistance.

# NEW PATENTS

## *Electrical Specifications Recently Published*

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

**1939**

18965. "Synchronising systems and methods." Philco Radio & Television Corporation. August 12th, 1938. (535331.)

24545. "Production of urea formaldehyde resins." J. E. H. Hayward and Bakelite, Ltd. August 25th, 1939. (535176.)

25026. "Electrical coupling circuits." Marconi's Wireless Telegraph Co., Ltd., C. D. Colchester and A. T. Starr. August 31st, 1939. (535181.)

25038. "Operation of electric discharge devices." Pearce Signs, Ltd., H. W. Windebank and J. H. G. Pearce. August 31st, 1939. (Cognate application 2727/40.) (535334.)

25754. "AC electric circuit-breakers having arc control devices." A. Reyrolle & Co., Ltd., A. Allan and D. F. Amer. September 13th, 1939. (535217.)

26640. "Electric steaming irons." E. P. Schreyer. October 3rd, 1938. (535294.)

26873. "Construction of thermionic valves." Standard Telephones & Cables, Ltd., and F. D. Goodchild. September 29th, 1939. (535184.)

26932. "Polymerisable compositions." British Thomson-Houston Co., Ltd. October 1st, 1938. (535219.)

26954. "Electrical condensers and the manufacture thereof." A. H. Hunt, Ltd. October 1st, 1938. (535257.)

26984. "Suction cleaners." Hoover, Ltd. October 17th, 1938. (535258.)

27062. "Electron tube with double control." Egyesult Izzolampa es Villamossagi R.T. October 1st, 1938. (535338.)

27116. "Electrical signalling systems." Automatic Telephone & Electric Co., Ltd., E. B. Ireland and F. McCabe. October 3rd, 1939. (535300.)

27120. "Permanent magnet rotors for magneto-electric generators and like apparatus." Bendix Aviation Corporation. October 6th, 1938. (535302.)

27201. "Hand actuating devices for switches." J. G. Coles. October 4th, 1939 (535342.)

27204. "Permanent magnet alloy, and method of making the same." Indiana Steel Products Co. July 17th, 1939. (535343.)

27632. "Vehicle headlamps." E. Jarvis. October 6th, 1939. (Cognate application, 16086/40.) (535223.)

27653. "Electrical switches having resiliently mounted contacts." H. B. Prentice. October 11th, 1939. (535308.)

27893. "Manufacture of foundry moulds and cores." Soc. d'Electro-Chimie d'Electro-Metallurgie, et des Acieries Electriques d'Ugine. November 5th, 1938. (535226.)

28046. "Extrusion apparatus, particularly for applying sheathing to electric cables." J. Shaw & Sons (Salford), Ltd., and T. T. Clarke. October 17th, 1939. (535311.)

28601. "Tunable band-pass selector." Hazeltine Corporation. November 23rd, 1938. (535313.)

29177. "Electric flashlights." Platers & Stampers, Ltd. (E. Katzinger Co.). November 1st, 1939. (535315.)

29319. "Washing machines." British Thomson-Houston Co., Ltd. November 3rd, 1938. (535318.)

29631. "Fittings for electric lamps." Wardle Engineering Co., Ltd., and D. H. Ogley. November 8th, 1939. (535233.)

30506. "Magneto-ignition apparatus." British Thomson-Houston Co., Ltd., and T. F. Robinson. November 21st, 1939. (535238.)

30943. "Mixing and like gyratory apparatus." British Thomson-Houston Co., Ltd., and G. A. Williams. November 28th, 1939. (535241.)

32752. "H.p.m.v. electric discharge devices." General Electric Co., Ltd., V. J. Francis and E. Kettlewell. December 22nd, 1939. (535244 )

32908. "Armouring for cables, hosepipes, and the like." Liverpool Electric Cable Co., Ltd., and J. T. Frost. December 27th, 1939. (535354.)

32950. "Arc-welding electrodes." British Thomson-Houston Co., Ltd. December 28th, 1938. (535355.)

32951. "Welding electrodes." British Thomson-Houston Co., Ltd. December 28th, 1938. (535356.)

**1940**

246. "Cyclone separators." Sturtevant Engineering Co., Ltd., and M. Guelikman. January 4th, 1940. (535360.)

530. "Instrument movements." English Electric Co., Ltd., and G. Tilstone. January 10th, 1940. (535270.)

766. "Quadrantal error-correcting devices for directional aerial systems." Marconi's Wireless Telegraph Co., Ltd., and J. H. Moon. January 12th, 1940. (535193.)

1079. "Lever-operated electric switches." C. H. Parsons, Ltd., and G. B. Handley. January 18th, 1940. (535362.)

1822. "Operating systems for gas-blast circuit-breakers." British Thomson-Houston Co., Ltd., H. E. Cox and H. E. Nicholson. January 30th, 1940. (535365.)

1922. "Protective arrangements for use with direct-current electric supply systems." General Electric Co., Ltd., and W. G. Thompson. January 31st, 1940. (535276.)

2463. "Electron-discharge tubes." G. H. Taylor. February 8th, 1940. (535277.)

2981. "Electric insulators for transposing the conductors of transmission lines." Standard Telephones & Cables, Ltd. February 21st, 1939. (Addition to 484441.) (535280.)

3337. "Methods of removing moisture or gases from solid objects." British Thomson-Houston Co., Ltd. February 24th, 1939. (535194.)

3922. "Electrical heat treatment." Budd Induction Heating, Inc. March 24th, 1939. (535202.)

4603. "Control of transmission in two-way telephone systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). March 12th, 1940. (535286.)

4875. "Suppression of abnormal voltage rise in electric transformer windings." British Thomson-Houston Co., Ltd. (Tokyo Shibaura Denki Kabushiki Kaisha). March 15th, 1940. (535288.)

# Supervisors' Salaries

THE Association of Supervising Electrical Engineers has drawn up new schedules of minimum salaries for supervisory employees in the electrical contracting and installation industry and in electrical manufacturing and general maintenance work. In each case the minimum salaries (exclusive of wartime adjustments) are set out in three groups—(*a*) London district ; (*b*) Provincial cities and large towns ; and (*c*) Rural and urban districts.

The three grades specified for the electrical contracting industry are :—1, Foreman ; 2, Supervising electrical engineer ; and 3, Engineer and manager. For Grade 1 the following rates are laid down :—(*a*) £5 10s. per week, or £286 per annum, rising by annual increments of 5s. per week to £6 10s. per week, or £338 per annum. (*b*) £5 per week, or £260 per annum, rising by annual increments of 3s. per week to £5 15s. per week, or £299 per annum. (*c*) £4 10s. per week, or £234 per annum, rising by annual increments of 3s. per week to £5 5s. per week, or £273 per annum.

For Grade 2 the rates are as follows :—(*a*) £7 per week, or £364 per annum, rising by annual increments of 10s. per week to £10, or £520 per annum. (*b*) £6 per week or £312 per annum, rising by annual increments of 7s. 6d. per week to £8 5s. per week, or £429 per annum. (*c*) £5 per week, or £260 per annum, rising by annual increments of 6s. per week to £6 10s. per week, or £338 per annum.

The Grade 3 salaries are :—(*a*) £468 per annum, rising by agreed increments to £780 per annum. (*b*) £420, rising to £650 per annum. (*c*) £338, rising to £520 per annum.

There are also three grades for electrical manufacturing and general maintenance :—1, Departmental or shop foreman or electrician in charge of plant ; 2, Works superintendent or assistant works manager ; and 3, Works manager or maintenance engineer (with executive responsibility and supervision of men). For these the rates are the following :—Grade 1. (*a*) £5 5s. per week, or £273 per annum, rising by annual increments of 5s. per week to £6 5s. per week, or £325 per annum. (*b*) £4 10s. per week, or £234 per annum, rising by annual increments of 4s. per week to £5 10s. per week, or £286 per annum. (*c*) £4 per week, or £208 per annum, rising by annual increments of 2s. 6d. per week to £4 15s. per week, or £247 per annum.

Grade 2. (*a*) £6 per week, or £312 per annum, rising by annual increments of 7s. 6d. per week to £9 per week, or £468 per annum. (*b*) £5 5s. per week, or £273 per annum, rising by annual increments of 6s. 6d. per week to £7 17s. per week, or £408 4s. per annum. (*c*) £4 15s. per week, or £247 per annum, rising by annual increments of 5s. per week to £6 per week, or £312 per annum.

Grade 3. (*a*) £442 per annum, rising by agreed increments to £700 per annum. (*b*) £325, rising to £585 per annum. (*c*) £299, rising to £450 per annum.

The schedules also set out conditions relating to holidays and termination of employment.

## Multi-fuel Boilers

A sixth boiler designed for firing with waste products has now been installed by the South African Iron and Steel Industrial Corporation. These boilers are of the Yarrow "SF.3" type with lofty combustion chambers bordered by straight and nearly vertical tubes and have a m.c.r. of 50,000 lb. per hour with steam conditions of 310 lb. per sq. in. and 760 deg. F.

According to the *South African Mining & Engineering Journal* these boilers are fitted with louvre stokers for burning coke breeze and duff coal on the sandwich system. The coke breeze is too small for the blast furnaces and the coal is a waste product of the Witbank Collieries coal washing plant; either can be burnt alone and the proportions can be varied to suit the conditions. Surplus blast furnace gas, up to 500,000 cu. ft. per hr. per boiler, is also used through three Hunter force-draught burners. In addition each boiler is equipped with four burners for surplus tar as a supplementary fuel. Provision is also made to use any surplus coke-oven gas.

# FINANCIAL SECTION

## *Company News. Liquidations and Bankruptcies. Stock Exchange Activities.*

## Reports and Dividends

**Hall Telephone Accessories (1928), Ltd.,** reports net profits, before tax, for 1940 of £68,639, as compared with £41,606 for 1939. The dividend for the year is maintained at 10 per cent.

**Laurence, Scott & Electromotors, Ltd.,** report a profit of £119,178 for 1940, as compared with £123,314 for 1939. The dividend for the year on the "A" and "B" ordinary shares is maintained at 15 per cent.

**Allen West & Co., Ltd.,** report a net profit for the year ended January 31st of £51,931, as compared with £62,654 for 1939–40. It is again proposed to pay a dividend of 7½ per cent.

**Ransomes & Rapier, Ltd.,** report trading profits for 1940 of £153,849, as compared with £104,582 for 1939, but net earnings declined from £22,503 to £17,592, mainly owing to increased charges for taxes. The final ordinary dividend is 3 per cent., making 6 per cent., tax free for the year (against 6½ per cent., tax free), and £3,524 is carried forward (against £3,537 brought in).

**The Ever Ready Co. (Great Britain), Ltd.,** has announced a final ordinary dividend of 20 per cent., plus a bonus of 5 per cent., maintaining the distribution for the year at 40 per cent.

**Sangamo Weston, Ltd.,** report a profit for the past year of £16,392. A first and final dividend of 10 per cent. is proposed (against 5 per cent.).

**The Quebec Power Co.,** is maintaining its quarterly dividend on the common shares at 25 cents per share.

**The Southern Areas Electric Corporation, Ltd.,** is again paying an ordinary dividend of 5 per cent. for 1940.

**The Sphere Investment Trust, Ltd.,** shows a net revenue for the year ended March 31st of £41,941, as compared with £53,506 for the preceding year. The ordinary dividend for the year is 5 per cent. (same).

**The Atlas Electric & General Trust, Ltd.,** has announced a final dividend of 3½ per cent. on the 7 per cent. cumulative preference shares, making 7 per cent. for the year ended March 31st.

**The West Devon Electric Supply Co., Ltd.,** is again paying a dividend of 5 per cent. for the past year.

**Herbert Morris, Ltd.,** have declared an interim ordinary dividend of 5 per cent., tax free (against 7½ per cent. tax free).

**Hopkinsons, Ltd.**—The profit for 1940-41, before meeting taxation, was £240,600 (against £209,130). The dividend is maintained at 15 per cent. by a final payment of 10 per cent.

**The Isle of Thanet Electric Supply Co., Ltd.,** has deferred payment of the dividend on the cumulative participating preference shares for the half-year to March 31st last.

**The West Gloucestershire Power Co.** is maintaining its distribution for the past year at 4½ per cent.

## New Companies

**Ceiba, Ltd.**—Private company. Registered April 19. Capital £100. Objects: To carry on the business of electrical equipment specialists, manufacturers and repairers of, and dealers in, batteries, accumulators, dynamos, transformers and accessories, radio specialists and dealers, &c. Directors: F. Mansell, and Mrs. B. Mansell, both of 64 Auckland Road, S.E.19.

**Pinner Battery Co., Ltd.**—Private company. Registered April 12th. Capital £100. Objects: To carry on the business of manufacturers, exporters and importers of, and wholesale and retail dealers in, dry cells and batteries, electrical specialities and lamps, &c. Directors: H. Cole and V. Cole, both of 107, Imperial Drive, North Harrow, Middlesex; and two others. Secretary: B. J. Ashurst. Registered office: 46, Coronation Parade, Cannons Lane, Pinner, Middlesex.

## Companies' Returns

**Electric Reduction Co., Ltd.** — Capital £50,000 in 16,200 preference and 33,800 ordinary shares of £1. Return dated October 28th, 1940. 16,200 preference and 28,800 ordinary shares taken up. £18,000 paid on 13,000 preference and 5,000 ordinary. £27,000 considered as paid on the remainder. Mortgages and charges: £25,000.

**A. V. Caldwell, Ltd.**—Capital £1,000 in 1,000 shares of £1 each. Return dated October 24th, 1940. All shares taken up. £1,000 paid. Mortgage and charges: Nil.

**John Dugdill & Co., Ltd.**—Capital £10,000 in £1 shares. Return dated October 28th, 1940. All shares taken up. £3 paid. £9.997 considered as paid. Mortgages and charges: Nil.

### Increase of Capital

**Painton & Co., Ltd.**—The nominal capital has been increased by the addition of £4,000 in £1 shares beyond the registered capital of £1,000.

### Mortgages and Charges

**D.C. Engineering Co., Ltd.**—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated March 31st, 1941, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

## Liquidations

**John Baker & Son (Electrical), Ltd.,** electrical dealers, 30, Clifton Road, Maida Vale, London, W.9.—The statutory meeting of creditors was held recently at the above address, when figures were submitted showing liabilities totalling £1,648. The assets were £731 and in addition the goodwill appeared in the books at £719. There was a debit balance on the profit and loss account of £198. It was decided that the voluntary liquidation of the company should be confirmed with Mr. B. C. Pocock, of Leith Mansions, Maida Vale, London, W., as liquidator, cash and other claims totalling £584 being withdrawn.

## Bankruptcies

**Ernest Prince,** radio and electrical dealer, 1, Bellcroft Villas, Allerton Bywater, Yorkshire, lately carrying on business at 3, Sagar Street, Castleford.—This debtor attended at the Court House, Wood Street, Wakefield, recently, for his public examination on accounts showing a deficiency of £103. There were no assets. The failure was ascribed to lack of capital, bad trade and family illness. The examination was adjourned for closing.

**R. A. J. Tully,** electrician, 32J, Viaduct Road, Brighton.—Discharged as from March 21st, 1941.

**W. N. Bishop,** electrical engineer, 39, College Avenue, Maidenhead.—Trustee, Mr. J. B. Simmons, 8, Forbury, Reading, Official Receiver, released April 16th.

**T. P. Wood** and **T. George** (trading as T. P. Wood), electrical contractors, 28, Queen Street, Ipswich.—Last day for receiving proofs for dividend May 9th. Trustee, Mr. K. E. Fisk, 13A, Great Colman Street, Ipswich, Official Receiver.

**J. K. Thornborough** and **E. C. Thornborough** (J. K. Thornborough & Co), electricians, Crescent Road, Windermere.—First and final dividend of 1s. 9¾d. in the £ payable May 7th at 16, Cornwallis Street, Barrow-in-Furness.

**M. Franks,** electrical and radio engineer, 4, Bayford Road, lately carrying on business at Arcade Road, Littlehampton.—Trustee, Mr. C. Latham, 185-8, High Holborn, London, W.C.1, released January 21st.

**E. A. Kann,** electrical and radio manufacturers' agent, 61, Lansdowne Place, Hove.—Last day for receiving proofs for dividend May 9th. Trustee, Mr. A. C. Williams, 8, Old Steine, Brighton, Official Receiver.

**H. Beaumont,** electrical engineer and radio dealer, 207, Luck Lane, Paddock, Huddersfield.—First and final dividend of 3s.1¾d. in the £, payable May 6th at 71, Manningham Lane, Bradford.

# Brazilian Electrical Imports

BRAZIL'S total imports of electrical machinery and appliances in 1939 were valued at £1,647,000 (gold). The principal items are shown in the accompanying table. On account of changes in the classification, showing greater detail than before, comparative figures cannot be given.

| | 1939 £ (000) |
|---|---|
| Radio telegraph and telephone apparatus | 14 |
| Telegraph and telephone receiving apparatus | 171 |
| Radio telephone and radio telegraph receiving apparatus | 39 |
| Radio apparatus for household use | 244 |
| Radio accessories, unspecified | 67 |
| Radio valves | 50 |
| Electro-dental apparatus | 15 |
| X-ray lamps | 12 |
| Electro-medical apparatus and parts | 54 |
| Accumulators and batteries | 33 |
| Generators and dynamos | 138 |
| Generator sets, steam or hydro-electric | 7 |
| Gas-driven generator sets | 14 |
| Motors | 97 |
| Cells | 13 |
| Static transformers | 108 |

| | 1939 £ (000) |
|---|---|
| Electric lamps, ordinary | 18 |
| Electric lamps, special | 11 |
| Lighting material, unspecified | 19 |
| Flat irons | 1 |
| Electric polishers, etc. | 36 |
| Domestic apparatus, unspecified | 9 |
| Vacuum cleaners | 26 |
| Insulated copper wire | 24 |
| Copper cable | 52 |
| Electrical carbons | 20 |
| Glass insulators | 1 |
| Other insulators | 9 |
| Switchboards | 28 |
| Measuring apparatus | 33 |
| Sound amplifiers | 3 |
| Lightning arrestors | 6 |
| Electric lifts | 51 |

A large number of countries compete for the trade. The United States is responsible for half the total and Germany, in 1939, did nearly one-fifth of the business. Great Britain, Holland and Sweden were all some way behind—each with only about a fifteenth. Minor shares were taken, in order of importance, by Switzerland, Italy, France, Japan, Canada and Denmark.

Since the period covered by the returns Japan has been more in evidence in the electrical trade in more than one South American State. She has been quoting on telephone equipment for Brazil and has received orders for hundreds of sets, including desk and wall telephones.

Factory enterprise has developed remarkably and doubled the value of its production between 1927 and 1938. Since then the interference with the supply of imported goods which has been caused by the war has given additional stimulus to the movement. In 1936 there were 110 establishments producing batteries, lamps and the simpler forms of electrical apparatus, but nearly three-quarters of the number employed six persons or less. In 1938 over 14,000,000 lamps were turned out, while 148,000 batteries were made. The other types of electrical apparatus manufactured numbered 168,000. South Africa is Brazil's largest outlet for batteries.

# STOCKS AND SHARES

TUESDAY EVENING

THE present feature of Stock Exchange markets is the strength of the 3½ per cent. War Loan. The price has risen substantially during the past few business days, and the reflection of this improvement is noticeable amongst the securities of any kindred character. Central Electricity Board issues are generally better, but the only notable change is a rise of 1 in the 3½ per cent. stock 1963/93.

Until the position in Greece and Egypt clarifies, Stock Exchange members look for no real accession of business, but pending further developments, the chief characteristic of the Stock Exchange markets is the firmness of the prices in all the investment departments. The price alterations on the week are negligible.

**The Treasury's Requisition**

The Treasury will make payment, on dates beginning June 3rd next, for a fifth batch of United States securities held by British residents. This list is the longest so far published. It includes 125 stocks and 39 bonds. Many of these are—or, before the war, were—popular investments amongst the investing classes in this country. To some of them a speculative flavour attached, but in the majority of cases the stocks and the bonds went to the more permanent investor who held them for income purposes.

Amongst the recently requisitioned American stocks are a number of those connected with electric light and power. The Treasury will pay in sterling at prices which have been announced, and which ruled on April 19th last. The prices include an allowance for the interval of approximately six weeks between the date of the Order to the due date of payment. International Telephone and Telegraph 5 per cent. gold debenture bonds, 1955, are to be repaid at £10 18s. 7d. per $100 nominal. Cities Service Power & Light 5½ per cent. gold debentures, 1952, will receive £25 0s. 1d. per $100. Amongst the speculative shares, one of the best-known on this side is Electric Bond and Share Company common, holders of which are to receive 11s. 3d. per $5 share.

**Obtaining Dollar Exchange**

Holders of these dollar shares and bonds are given no option as to whether they shall sell. The Treasury will take the securities under the Vesting Order and if a holder, either by accident or design, should omit to supply the issues that are required, it is probable that future prices will be less than those which are now to be paid by the British Government. The object, as everyone knows, is to enable the Government to obtain, through the sale of these securities in New York, the dollar exchange that it requires for payment of American munitions ordered before the Lease and Lend Bill came into operation. Speculation as to the manner in which the British Treasury will dispose of the securities is inclined to take the view that the stocks and shares will not be sold in the open market, but will be handed over in blocks to American financial houses, who will realise them by degrees.

By reason of the knowledge that this money will be distributed in this country early in June, prices of our gilt-edged stocks have improved. The assumption is that part, at all events, of the cash will be employed in stocks and shares outside the list of Government war offerings into which the greater proportion, no doubt, will be turned. Where stocks and shares now requisitioned have been paying 6 or 7 per cent. on the money, the holders may feel that a portion of their capital will require a higher yield than that offered by our 2½ and 3 per cent. War Loans. This consideration is quickening the demand for front-rank preference shares in British industrial companies. It has hardly made its influence felt, so far, amongst ordinary shares, the prices of which are disposed, if anything, to dullness owing to the uncertainty felt as to how heavily the E.P.T. and other tax requirements will bear upon distributable earnings on ordinary shares.

**Preferences on Offer**

Preference shares in the electricity supply companies are by no means easy to obtain. County of London 4 per cent. preference, for instance, cost a little over the par value of £1. Bournemouth and Poole 6 per cent. preference are on offer at 30s. 6d.; Shropshire, Worcestershire 6 per cent. preference, at 31s. 3d.; South Metropolitan 4 per cent. third preference at 20s. 6d.; all of these showing returns of a shilling or two under 4 per cent. A small block of West Kent Electric 4½ per cent. preference is obtainable at 21s. 4d. to yield 4¼ per cent. on the money. The amount required for payment of the dividend on the last-named is £22,500 per annum; the amount available in the last-published figures was £71,000. A moderate amount of British Electric Traction 8 per cent. non-cumulative preference stock is on offer at 160, July and December dividends. This gives 5 per cent. on the money and is well secured. Some people, however, object to a preferred or preference stock on which the dividend is not cumulative.

**Movements in Prices**

A fall of 1/16 in North Eastern Electric ordinary shares to 27s. 6d., and a rise of a similar fraction in the company's 7 per cent. preference shares, illustrate the pressure which continues on the part of investment to acquire the better securities. The drop in the ordinary shares is due to a small deceased account coming on the market which, generally speaking, is firm, with an ¼ rise in Electrical Distribution of Yorkshire to 38s. 9d. County of London are a little easier at 30s. middle. The maintenance of the 5 per cent. dividend on Southern Areas shares has left the price unchanged, allowing for the deduction of the dividend, at 15s. 9d. Cable and Wireless ordinary hardened to 62, the preference coming on offer at 98. The dividend announcement should be made during the present week and estimates range from 4 to 4½ per cent. on the ordinary. Anglo-Portuguese Telephones have eased off to 15s.

Amongst equipment and manufacturing shares, Ever Ready are unchanged at 25s. 6d., the dividend announcement, making, as before, 40 per cent. for the year, being regarded as satisfactory, but having no effect upon the market. Chloride Electrical Storage are quoted nominally ¼ lower at 60s. In reality this official price is incorrect: 63s. would be nearer the middle dealing quotation. Hall Telephone shares strengthened to 11s. 3d., at which price the return is a little under 9 per cent. on the money; Laurence Scott reacted to 8s. 6d. In the engineering group, Babcocks and Vickers are both a trifle down.

**Home Railway Hesitations**

The demand for purely investment stocks is making its influence felt amongst the prior-charges of the Home Railway companies, but investment remains shy of putting money into the junior issues, owing to what is considered to be the uncertain nature of the outlook for Home Railways. Details are not published even yet of the new arrangements between the Government and the companies that were expected to be agreed at the beginning of this year, and which are to supersede the contract made in February, 1940. On top of this, doubt prevails in references to what obligation the companies are likely to be called upon to shoulder through the War Damage Bill. Home Railway debenture and preference stocks are favourably regarded, but the general market is in a lackadaisical condition. This is reflected in the failure of prices to make such progress as might otherwise be expected to take place in response to the high yields that the junior stocks afford.

London Passenger Transport "C," for instance, remains at 31; Southern 5 per cent. preferred is 1½ down at 46; the average yield from the two stocks is over 10 per cent. on the money. British Electric Traction stocks maintain their previous prices and Tillings shares keep very firm in spite of the modesty of the £4 14s. per cent. yield on the money at the present price of 42s. 6d.

**Misleading Margin**

The attention of the Stock Exchange Committee has been called to the wide margin that exists in the case of the prices of a great many of the stocks and shares that appear in the lists issued under the authority of the Committee. One striking instance was that of 100 points margin between the selling and buying prices of British Electric Traction deferred stock. In consequence of the representations, the margin has been narrowed to 50 points, the official quotation now being 750 to 800 against 750 to 850 previously. It has been explained here on previous occasions that the prices given in our share lists are the middle quotations furnished by the Stock Exchange official records. In these, plenty of scope exists for a reform that has long been overdue. In the case of the Home electricity supply companies, for instance, the margins between the selling and buying prices are frequently half-a-crown, *e.g.*, County of London, Lancashire Electric, London Associated, Metropolitan, North Eastern, Scottish Power, and a number of others.

In the Stock Exchange market, the margin at which a broker deals for his client in shares of this description is usually about 1s. to 1s. 6d. per share. There is little, if any, reason why a more accurate representation of the real market price should not be given than is afforded under the present complaisant sanction of the Committee. The matter is one which affects the public interest in no small measure. War conditions make a general reform somewhat difficult to undertake, but, on the other hand, the effect of there being so little business afoot offers a suitable opportunity for bringing official prices into closer correspondence with those obtainable in the market.

# Ministry of Labour Handbook

A 20-page booklet just issued by the Ministry of Labour & National Service should prove useful to employers' and employees' organisations for whose benefit it has been primarily produced. It sets out in some detail the organisation of the Ministry's many services, central and local, and notes the functions of each.

Among the departments so dealt with are the Labour Supply Board and Departments, the Engineering Branch, the Training Department, Factory and Welfare Advisory Board and Departments, National Service Department, Industrial Relations Department, Trade Boards Department, Unemployment Insurance Department, Divisional Offices and Employment Exchanges, Factory Inspectorate and Industrial Relations Officers.

# ELECTRICAL COMPANIES' SHARES

## *Prices, Dividends and Yields*

| Company | 1941 High-est | 1941 Low-est | Dividend Pre-vious | Dividend Last | Middle Price April 29 | Rise or Fall | Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|---|
| **Home Electricity Companies** | | | | | | | |
| Bournemouth and Poole .. | 48/6 | 45/– | 15 | 12½ | 46/3 | .. | 5 8 3 |
| British Power and Light .. | 27/9 | 23/– | 7 | 6 | 24/6 | .. | 4 18 0 |
| City of London .. .. | 22/6 | 20/– | 7½ | 7 | 21/3 | .. | 6 11 9 |
| Clyde Valley .. .. | 36/6 | 33/6 | 8 | 8 | 35/– | .. | 4 11 5 |
| County of London .. .. | 34/6 | 30/– | 10½ | 8 | 30/– | .. | 5 6 8 |
| Edmundson's : | | | | | | | |
| 7% Pref. .. .. | 30/– | 25/6 | 7 | 7 | 30/– | .. | 4 13 4 |
| Ord. .. .. | 25/6 | 23/6 | 9 | 6 | 25/6 | +6d. | 4 14 0 |
| Elec. Dis. Yorkshire .. | 38/3 | 36/– | 9 | 9 | 38/9 | +½ | 4 12 9 |
| Elec. Fin. and Securities .. | 40/– | 39/– | 12½ | 12½ | 40/– | .. | 6 5 0 |
| Elec. Supply Corporation .. | 37/9 | 36/– | 11½ | 10 | 37/6 | .. | 5 6 8 |
| Isle of Thanet .. .. | 8/– | 6/– | 4 | 4 | 7/– | .. | — |
| Lancs Light and Power .. | 31/6 | 28/6 | 7½ | 7½ | 31/3 | .. | 4 16 0 |
| Llanelly Elec. .. .. | 21/– | 19/6 | 5½ | 5½ | 20/– | .. | 5 10 0 |
| Lond. Assoc. Electric .. | 16/6 | 12/6 | 5½ | 4½ | 15/9 | .. | 5 14 3 |
| London Electric .. .. | 23/6 | 21/3 | 7 | 7 | 22/6 | .. | 6 4 5 |
| London Power Deb. Red... | 105½ | 102 | 5 | 5 | 102½ | .. | 4 17 6 |
| Metropolitan .. .. | 34/6 | 31/– | 10 | 8 | 31/3 | .. | 5 2 3 |
| Midland Counties .. .. | 35/6 | 32/9 | 8 | 8 | 35/– | .. | 4 11 5 |
| Mid. Elec. Power .. .. | 35/– | 33/3 | 9 | 9 | 35/– | .. | 5 2 10 |
| Newcastle Elec. .. .. | 26/3 | 24/6 | 7 | 7 | 25/– | .. | 5 12 0 |
| North Eastern Elec.: | | | | | | | |
| Ordinary.. .. .. | 29/– | 25/6 | 7 | 7 | 27/6 | –½ | 5 1 10 |
| 7% Pref... .. .. | 31/6 | 29/– | 7 | 7 | 32/6 | +½ | 4 6 2 |
| Northampton .. .. | 2½ | 39/6 | 10 | 10 | 41/3 | .. | 4 17 0 |
| Notting Hill 6% Pref. (£10) | 9 | 8 | 6 | 6 | 8½ | .. | — |
| Northmet Power: | | | | | | | |
| Ordinary.. .. .. | 34/6 | 28/6 | 10 | 7 | 28/9 | .. | 4 17 4 |
| 6% Pref... .. .. | 29/6 | 27/3 | 6 | 6 | 29/– | .. | 4 2 9 |
| Richmond Elec. .. .. | 19/– | 18/– | 6 | 6 | 18/9 | .. | 6 8 0 |
| Scottish Power .. .. | 36/6 | 33/– | 8 | 8 | 36/3 | .. | 4 8 5 |
| Southern Areas .. .. | 16/6 | 14/6 | 5 | 5 | 15/9xd. | .. | 6 7 0 |
| South London .. .. | 20/– | 19/3 | 7 | 7 | 20/– | .. | 7 0 0 |
| West Devon .. .. | 21/6 | 20/9 | 5 | 5 | 21/3 | .. | 4 14 1 |
| West Gas.. .. .. | 18/3 | 17/3 | 2½ | 4½ | 17/6 | .. | 5 2 10 |
| Yorkshire Elec. .. .. | 38/3 | 34/6 | 8 | 8 | 38/3 | .. | 4 4 0 |
| **Overseas Electricity Companies** | | | | | | | |
| Atlas Elec. .. .. | 2/6 | 1/9 | Nil | Nil | 2/– | .. | — |
| Calcutta Elec. .. .. | 37/3 | 33/– | 10* | 8* | 37/– | .. | 4 6 8 |
| Cawnpore Elec. .. .. | 30/– | 26/– | 10 | 10 | 27/6 | .. | 7 5 9 |
| East African Power .. | 25/6 | 21/6 | 7 | 7 | 25/– | .. | 5 12 0 |
| Jerusalem Elec. .. .. | 22/6 | 19/3 | 7 | 7 | 21/3 | .. | 6 11 9 |
| Kalgoorlie (10/–) .. .. | 12/6 | 11/– | 7½ | 7½ | 12/6 | .. | 6 0 0 |
| Madras Elec. .. .. | 25/3 | 24/6 | 8* | 6* | 23/9 | –½ | — |
| Montreal Power .. .. | 31 | 30 | 1½ | 1½ | 24½ | .. | 6 2 5 |
| Palestine Elec. "A" .. | 20/6 | 17/6 | 5* | Nil | 17/6 | .. | — |
| Perak Hydro-electric .. | 18/3 | 16/3 | 2½ | 6 | 17/6 | .. | 6 17 2 |
| Shawinigan Power .. | 18½ | 16 | 83cts. | 90cts. | 15xd. | .. | — |
| Tokyo Elec. 6% .. .. | 40½ | 36 | 6 | 6 | 37½ | –1 | 16 0 0 |
| Victoria Falls Power .. | 76/6 | 69/6 | 15 | 15 | 75/– | .. | 4 0 0 |
| Whitehall Investments Pref. | 14/9 | 11/3 | 7½ | 7½ | 12/6 | .. | 12 0 0 |
| **Public Boards** | | | | | | | |
| Central Electricity : | | | | | | | |
| 1950–70 .. .. .. | 110½ | 108 | 5 | 5 | 110 | .. | 4 11 0 |
| 1955–75 .. .. .. | 112½ | 109½ | 5 | 5 | 112 | .. | 4 9 3 |
| 1951–73 .. .. .. | 108 | 105½ | 4½ | 4½ | 108 | .. | 4 3 4 |
| 1963–93 .. .. .. | 100 | 94 | 3½ | 3½ | 101 | +1 | 3 9 4 |
| 1974–94 .. .. .. | 92 | 87½ | 3½ | 3½ | 92 | .. | 3 10 8 |
| London Elec. Trans. Ltd... | 94 | 91½ | 2½ | 2½ | 94 | .. | 2 13 2 |
| London & Home Counties | | | | | | | |
| 1955–75 .. .. .. | 108 | 106 | 4½ | 4½ | 108 | .. | 4 3 4 |
| Lond. Passenger Transport : | | | | | | | |
| A .. .. .. .. | 120 | 109 | 4½ | 4½ | 119½ | .. | 3 15 4 |
| B .. .. .. .. | 114 | 102½ | 5 | 5 | 113½ | .. | 4 8 0 |
| C .. .. .. .. | 36 | 29 | 1½ | 3 | 31 | .. | 9 13 6 |
| West Midlands Joint Elec. | | | | | | | |
| 1948–68 .. .. .. | 108 | 103 | 5 | 5 | 107½ | .. | 4 13 0 |
| **Telegraph and Telephone** | | | | | | | |
| Anglo-Am. Tel.: | | | | | | | |
| Pref. .. .. .. | 102½ | 99.. | 6 | 6 | 102½ | .. | 5 17 1 |
| Def. .. .. .. | 24 | 22 | 1½ | 1½ | 23½ | .. | 6 7 8 |
| Anglo-Portuguese .. .. | 17/3 | 15/– | 8 | 8 | 15/– | –½ | 10 13 4 |
| Cable & Wireless : | | | | | | | |
| 5½% Pref. .. .. | 102 | 93 | 4½ | 5½ | 98½ | –1* | 5 11 8 |
| Ord. .. .. .. | 63 | 52½ | 4 | 4 | 62 | +1 | 6 9 3 |
| Canadian Marconi $1 .. | 5/– | 4/– | Nil | 4cts. | 5/– | .. | 3 4 0 |
| Globe Tel. & Tel.: | | | | | | | |
| Ord. .. .. .. | 29/– | 26/– | 7½* | 6* | 28/9 | .. | 4 3 6 |
| Pref. .. .. .. | 27/6 | 25/– | 6 | 6 | 27/6 | .. | 4 7 3 |
| Great Northern Tel. (£10).. | 14 | 10½ | 20 | 20 | 12½ | .. | — |
| Inter. Tel. & Tel. .. .. | 3½ | 2½ | Nil | Nil | 3 | .. | — |
| Marconi-Marine .. .. | 23/– | 19/9 | 10 | 7½ | 22/6 | .. | 6 13 2 |
| Oriental Telephone Ord. .. | 55/6 | 47/– | 12* | 11½* | 2½ | .. | 4 3 8 |
| Telephone Props. .. .. | 11/6 | 11/– | 6 | 6 | 11/3 | .. | 10 13 4 |
| Telephone Rentals (5/–) .. | 7/9 | 6/9 | 10 | 10 | 7/3 | .. | 6 18 0 |

| Company | 1941 High-est | 1941 Low-est | Dividend Pre-vious | Dividend Last | Middle Price April 29 | Rise or Fall | Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|---|
| **Traction and Transport** | | | | | | | |
| Anglo. Arg. Trams : | | | | | | | |
| First Pref. (£5) .. .. | 2/3 | 1/– | Nil | Nil | 2/– | .. | — |
| 4% Inc. .. .. .. | 8½ | 4 | Nil | Nil | 4½ | .. | — |
| British Electric Traction : | | | | | | | |
| Def. Ord. .. .. | 830 | 740 | 5 | 45 | 775 | .. | 5 16 2 |
| Pref. Ord. .. .. | 167 | 150 | 8 | 8 | 160 | .. | 5 0 0 |
| Bristol Trams .. .. | 40/– | 36/– | 8* | 8 | 36/3 | .. | 4 8 5 |
| Brazil Traction .. .. | 8 | 6½ | $1 | 50c. | 7 | –½ | — |
| Calcutta Trams .. .. | 19/9 | 18/6 | 8 | 5½ | 19/– | .. | 5 15 8 |
| Cape Elec. Trams .. .. | 17/6 | 16/6 | 5 | 5 | 17/– | .. | 5 17 4 |
| Lancs Transport .. .. | 39/– | 36/– | 10 | 10 | 38/9 | .. | 5 3 1 |
| Mexican Light : | | | | | | | |
| 1st Bonds .. .. | 40 | 34½ | 5 | 5 | 40 | .. | — |
| Rio 5% Bonds .. .. | 85½ | 84 | 5 | 5 | 85 | .. | 5 17 8 |
| Southern Rly. : | | | | | | | |
| 5% Prefd. .. .. | 53½ | 43½ | 5 | 5 | 46 | –1½ | 10 17 6 |
| 5% Pref... .. .. | 94 | 77½ | 5 | 5 | 88½ | .. | 5 13 0 |
| T. Tilling .. .. .. | 43/6 | 34/6 | 10 | 10 | 42/6 | .. | 4 14 0 |
| Tilling & B.A. .. .. | 47/6 | 45/6 | 8* | 7* | 45/9 | .. | 3 1 2 |
| West Riding .. .. .. | 36/– | 34/– | 10 | 10 | 36/– | .. | 5 11 1 |
| **Equipment and Manufacturing** | | | | | | | |
| Aron Electricity Ord. .. | 18/6 | 10/– | 15 | Nil | 18/– | .. | — |
| Assoc. Elec.: | | | | | | | |
| Ord. .. .. .. .. | 41/– | 38/3 | 10 | 10 | 40/– | .. | 5 0 0 |
| Pref. .. .. .. .. | 36/– | 33/3 | 8 | 8 | 35/– | .. | 4 11 5 |
| Automatic Telephone & El. | 47/3 | 32/– | 12½ | 12½ | 41/3 | .. | 6 1 1 |
| Babcock & Wilcox .. | 43/3 | 39/– | 10 | 11 | 39/6 | –6d. | 5 11 4 |
| British Aluminium .. | 43/6 | 39/– | 12½ | 10 | 39/6 | .. | 5 1 3 |
| British Insulated Ord. .. | 88/3 | 78/9 | 20 | 20 | 82/6 | .. | 4 17 0 |
| British Thermostat (5/–) .. | 12/3 | 10/6 | 18½ | 18½ | 12/– | .. | 7 14 2 |
| British Vacuum Cleaner (5/–) | 6/3 | 6/– | 40 | 12½ | 6/3 | .. | 10 0 0 |
| Brush Ord. .. .. | 4/3 | 3/6 | Nil | Nil | 4/– | .. | — |
| Callender's .. .. .. | 65/6 | 58/6 | 15 | 15 | 61/3 | .. | 4 17 9 |
| Chloride Elec. Storage .. | 63/6 | 60/– | 15 | 15 | 60/– | –½ | 5 0 0 |
| Consolidated Signal .. | 65/– | 63/6 | 17 | 17 | 65/– | .. | 5 4 7 |
| Crabtree (10/–) .. .. | 23/9 | 21/3 | 17½ | 17½ | 22/6 | .. | 7 15 7 |
| Crompton Parkinson : | | | | | | | |
| Ord. (5/–) .. .. | 19/– | 17/9 | 30 | 20 | 18/9 | .. | 5 6 8 |
| E. K. Cole (5/–) .. .. | 4/9 | 2/9 | 10 | Nil | 4/6 | .. | — |
| Elec. & Musical Industries | | | | | | | |
| (10/–) .. .. .. | 8/6 | 7/3 | 5 | Nil | 7/6 | +3d. | — |
| Electric Construction .. | 27/6 | 25/– | 13½ | 10 | 27/6 | .. | 7 5 6 |
| Enfield Cable Ord. .. | 51/– | 45/– | 16½ | 12½ | 45/– | –½ | 5 11 3 |
| Electrical Switchgear (10/–) | 22/6 | 20/– | 16 | 10 | 20/– | .. | 5 0 0 |
| English Electric .. .. | 31/6 | 29/– | 10 | 10 | 31/3 | .. | 6 8 0 |
| Ensign Lamps (5/–) .. | 16/3 | 15/– | 25 | 25 | 15/– | .. | 8 6 3 |
| Ericsson Tel. (5/–) .. | 35/3 | 37/3 | 25* | 22* | 35/– | .. | 3 2 10 |
| Ever Ready (5/–) .. .. | 27/6 | 25/– | 40 | 40 | 25/6 | .. | 7 7 0 |
| Falk Stadelmann .. .. | 16/9 | 13/9 | 6 | 7 | 15/9 | .. | 8 17 10 |
| Ferranti Pref. .. .. | 25/6 | 23/6 | 7 | 7 | 25/– | .. | 5 12 0 |
| G.E.C. : | | | | | | | |
| Pref. .. .. .. | 33/– | 30/6 | 6½ | 6½ | 32/6 | .. | 4 0 0 |
| Ord. .. .. .. | 81/– | 77/– | 20 | 20 | 80/– | .. | 5 0 0 |
| Greenwood & Batley .. | 21/– | 18/6 | 15 | 13 | 20/– | .. | 13 0 0 |
| Hall Telephone (10/–) .. | 11/6 | 10/– | 15 | 10 | 11/3 | +½ | 8 17 10 |
| Henley's (5/–) .. .. | 21/6 | 19/6 | 20 | 20 | 20/– | .. | 5 0 0 |
| 4½% Pref. .. .. | 21/6 | 20/– | 4½ | 4½ | 21/3 | .. | 4 4 8 |
| Hopkinsons .. .. | 40/– | 37/6 | 15 | 15 | 40/– | .. | 7 10 0 |
| India-Rubber Pref. .. | 21/6 | 19/6 | 5½ | 5½ | 21/3 | .. | 5 3 6 |
| Intl. Combustion .. .. | 92/6 | 81/3 | 32½ | 30 | 92/6 | .. | 6 13 4 |
| J. Lucas .. .. .. | 58/– | 50/6 | 15 | 15 | 56/3 | .. | 5 6 9 |
| Johnson & Phillips .. | 48/3 | 44/– | 12½ | 15 | 45/– | .. | 6 13 4 |
| Lancashire Dynamo .. | 53/6 | 50/– | 25 | 20 | 52/6 | .. | 7 12 4 |
| Laurence, Scott (5/–) .. | 10/– | 7/– | 15 | 15 | 8/6 | –½ | 8 16 6 |
| London Elec. Wire .. | 25/6 | 20/– | 7½ | 7½ | 22/6 | .. | 6 13 4 |
| Mather & Platt .. .. | 37/9 | 32/– | 13½ | 10 | 37/– | .. | 5 8 1 |
| Metropolitan Elec. Cable Pf. | 22/– | 21/3 | 5½ | 5½ | 21/3 | .. | 5 3 6 |
| Murex .. .. .. | 84/6 | 75/– | 20 | 20 | 80/– | .. | 5 0 0 |
| Pye Deferred (5/–) .. | 11/6 | 10/9 | 25 | 25 | 11/3 | .. | 11 2 2 |
| Revo (10/–) .. .. | 21/3 | 18/9 | 17½ | 5 | 20/– | .. | 2 10 0 |
| Reyrolle .. .. .. | 52/6 | 47/9 | 12½ | 12½ | 50/– | .. | 5 0 0 |
| Siemens Ord. .. .. | 20/9 | 17/– | 7½ | 7½ | 20/– | .. | 7 10 0 |
| Strand Elec. (5/–) .. | 2/– | 1/– | 4 | 2 | 2/– | .. | 5 0 0 |
| S. Smith (1/–) .. .. | 7/3 | 5/9 | 37½ | 50 | 6/3 | .. | 8 0 0 |
| Switchgear & Cowans (5/–) | 9/– | 7/9 | 10 | 15 | 8/9 | .. | 8 11 6 |
| Telegraph Condenser (10/–) | 8/– | 7/– | Nil | 5 | 7/6 | .. | 6 13 4 |
| Telegraph Construction .. | 39/– | 34/6 | 10 | 10 | 37/6 | .. | 5 6 8 |
| Telephone Mfg. (5/–) .. | 7/6 | 6/9 | 9 | 9 | 7/3 | .. | 6 4 2 |
| Tube Investments.. .. | 92/6 | 89/– | 23½ | 23½ | 90/– | .. | 5 5 9 |
| Vactric (5/–) .. .. | 2/3 | 2/– | 4 | Nil | 2/3 | .. | — |
| Vickers (10/–) .. .. | 16/– | 14/– | 10 | 10 | 14/6 | .. | 6 13 4 |
| Ward & Goldstone (5/–) .. | 19/9 | 12/6 | 20 | 20 | 16/6 | .. | 5 19 9 |
| Westinghouse Brake .. | 42/6 | 39/6 | 17½ | 10 | 39/6 | –6d. | 5 1 3 |
| Walsall Conduits (4/–) .. | 26/6 | 24/6 | 55 | 55 | 26/3 | .. | 8 7 6 |
| West, Allen (5/–) .. .. | 4/3 | 3/6 | 10½ | 7½ | 3/9 | .. | 10 0 0 |

* Dividends are paid free of Income Tax.

# CONTRACT INFORMATION

## *Tenders Invited and Accepted. Schemes Promising Electrical Work.*

### Contracts Open

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in prentheses.*

**Birkenhead.**—May 12th. Electricity Dept. Stores for six months. (See this issue.)

**Bridgend.**—May 21st. Electricity Department. E.h.v. switchgear, transformers, e.h.v. and l.v. cables. (April 25th.)

**Cork.**—May 24th. North Cork Board of Health and Public Assistance. Supply and installation of mechanical equipment, electric motors and pumps, and other appliances, at Kanturk. Plans and specifications from D. C. Murphy, secretary, County Hospital, Mallow.

**Erith.**—May 7th. Borough Council. Gas-filled lamps. Conditions of contract and form of tender from J. H. Clayton, borough engineer, Council Offices.

**Stafford.**—In our issue of April 11th we stated that the Corporation Electricity Committee was calling for tenders for twelve months' supply of static transformers, whereas the authority concerned was Stoke-on-Trent Electricity Committee. We regret any inconvenience which this incorrect statement may have caused.

We understand, that Stoke-on-Trent Corporation later decided not to advertise and that the tender of the English Electric Co. has been accepted.

**West Midlands.**—May 28th. Joint Electricity Authority (Shropshire Distribution Area). Two 7,500-kVA and two 2,000-kVA transformers. (See this issue.)

### Orders Placed

**Brighton.**—Health Committee. Accepted for re-wiring at sanatorium: Orthopædic Ward.—Page & Miles (£88); Isolation Ward.—Adams Bros. & Broadbridge (£113).

Electricity Committee. Accepted. Transformers (£16,417).—British Electric Transformer Co.

**Durham.**—County Education Committee. Accepted. Installation of electric lighting at Bearpark Council School and Sherburn Council School.—J. Mayo.

**Swindon.**—Electricity Committee. Accepted. 33 kV switchgear.—B.T.H. Co.

### Contracts in Prospect

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Accrington.**—Rest centres in seven schools' and heating in shelters, for T.C.; H. Sanderson, borough engineer, Town Hall.

**Aldershot.**—Public library, for B.C.; borough engineer, Council Offices, Grosvenor Road.

**Bangor (Wales).**—Communal feeding centres for C.C.; B. P. Davies, city surveyor, Guildhall.

**Barnsley.**—Nurses' dining room and annexe, St. Helens Hospital (£2,020), for T.C.; H. Taylor, borough engineer, Town Hall.

**Barrow.**—Remand home for boys, for T.C.; borough engineer, Town Hall.

**Basingstoke.**—Workshop; Venture, Ltd.

**Batley.**—Improvements to Girls' Grammar and Technical Schools, for E.C.; borough engineer, Brunswick Street.

Crematorium, for T.C.; borough surveyor, Brunswick Street.

**Billericay.**—Community kitchens, Billericay, Laindon, Pitsea, Vange and Wickford, for U.D.C.; surveyor, Council Offices, High Street.

**Birmingham.**—Reconstruction of portions of Stechford School, and Central College of Arts and Crafts (£5,060), for T.C.; H. J. Manzoni, city engineer, The Council House.

**Bridlington.**—Auxiliary fire station, for T.C.; G. Melvin, town clerk, Town Hall.

**Brighton.**—Store and workroom, 105 Hollingbury Road; Pullars Electric Co., Ltd.

**Carmarthen.**—Fire station (£3,000), and additions to storerooms at Police Station, for T.C.; borough engineer, John Street.

**Chester-le-Street.**—Licensed premises, Waldridge; C. Vaux & Sons, brewers, Castle Street, Sunderland.

**Coatbridge.**—Extensions for City Bakeries, Ltd.; manager.

**Cork.**—Reconstruction and renovation of premises, Grattan Street, for South Cork County Board of Health; J. Hurley, secretary, Boardroom, Douglas Road.

**Coventry.**—Shop, Grosvenor Road; Holbrook & Son.

Reconstruction, Bull's Head Hotel, Bishop Street; H. P. Hing, architect, 121, Colmore Row, Birmingham.

**Denbighshire.**—Junior agricultural school at Llysfasi, for E.C.; county architect, Acton Hall, Wrexham.

**Gateshead-on-Tyne.**—Extensions to an adhesive material and glass factory; Liddle & Batchelor, Milburn House, Pilgrim Street, Newcastle-on-Tyne.

Warehouse, for Armstrong Whitworth, Ltd.; Bewley & Scott, Ltd., contractors, Dunston-on-Tyne.

**Glasgow.**—Workshop; Miller Insulating Co., Ltd.

Alterations and additions, Jessie Street, Palmadie; Alley & MacLellan, Ltd.

**Gloucestershire.**—Food and rest centres scheme (£60,000–£80,000), for C.C. Emergency Committee; county architect, Shire Hall, Gloucester.

**Greenford.**—Offices; Kelvin Construction Co., Ltd.

**Hurst.**—Hurst Hotel, Queen's Road, for Gartside's Brewery, Ltd., Ashton-under-Lyne; Drury and Gomersall, Imperial Buildings, Oxford Road, Manchester.

**Liverpool.**—Alterations, Great Howard Street, for "Karrier" Parcel Delivery Co., Ltd.; Tyson's (Contractors), Ltd., builders, Dryden Street.

**Manchester.**—Offices, warehouses and stores for Baxendale & Co., Ltd.; McCutcheon and Walsingham, architects, 1180a, Chester Road; Stretford.

Extensions, brick works, Lily Lane, Moston, for the Moston Brick and Building Co., Ltd.

**Morpeth (Northumberland).**—Feeding centre at Linton for the Morpeth Area Guardians Committee; J. E. Nicholson, clerk to the authority, Guardians offices.

**Peterborough.**—Additions; British Horticultural Co., Ltd., Werrington.

**Queenstown (Cobh).**—Houses (52), Belmont, for U.D.C.; town clerk, Town Hall.

**Rixton (Lancs).**—Extensions, Brickworks; T. Mosedale & Sons, Ltd.

**Rochdale.**—"British Restaurant," Wood Street (£5,190) and fourteen school canteens for T.C.; S. H. Morgan, borough surveyor, Town Hall.

**Salford.**—Repairing damaged houses for T.C.; W. A. Walker, borough engineer, Town Hall, Bexley Square.

**Shepshed (near Leicester).**—Public wash house and slipper baths for U.D.C.; J. G. Foston, surveyor, Council Offices.

**South Kirkby.**—Extensions to colliery workings, at South Kirkby and South Elmsall; South Kirkby, Featherstone and Hemsworth Collieries, Ltd., Ropergate Chambers, Pontefract.

**Standish (near Wigan).**—Houses, Moore's Lane, for U.D.C.; E. J. Brooks, surveyor, Council Offices.

**Trafford Park.**—Offices; Trafford Park Steel Warehouse Co.

**Tunstall.**—Workshop and offices, Furlong Road; Mr. H. Hoskins.

**Wallsend-on-Tyne.**—Extensions to offices, etc.; J. R. Rutherford & Sons, contractors, Minories Joinery Works, Jesmond, Newcastle-on-Tyne.

**Wellingborough.**—Store; Bignells, Ltd., Angel Lane.

**Willenhall.**—Completion of 64 houses, for U.D.C.; N. D. Martin, engineer, Council Offices.

# New Books

**Works Organisation and Management.** By E. J. Larkin. Pp. 464; figs. 335. Sir Isaac Pitman & Sons, Ltd., 39 Parker Street, London, W.C. 2. Price 35s.

Scientific management is the application of scientific knowledge to the industrial problems associated with manufacturing methods, equipment, materials and labour. During the past century many books on management have been published, some dealing with one phase of the subject and some another. In this book, the author has provided a comprehensive treatise on works organisation and management, which is interesting and instructive.

This is the age of the engineer, and the present titanic struggle has been described as a war of engineering. As this book is devoted to the engineering industry, its advent is both timely and welcome, for never in the national interest was there ever a greater or more urgent necessity for men skilled in the art of scientific management. Consideration has been given to all phases of the factory system, beginning with the selection of the site, the design of the buildings and the necessary services, and continuing with the equipment and machinery necessary for changing the shape and configuration of the raw materials necessary for production. Valuable information has been included in chapters devoted to personnel, safety of operators and to the training of the young engineer, a subject which at present is all important.

Efficiency in factory operation is extensively discussed under such headings as workshop expenses, waste elimination and payment by results, and the author has shown expert discrimination in the selection of the most important parts of the subject. Planning for production is dealt with in chapters on drawings, production planning, purchasing, progressing and scheduling. Quality control is given due consideration, and much useful information is given on the problems associated with storekeeping and stock control. Sales organisation, estimating and tendering are also included, which add to the comprehensive nature of the volume.

All phases of the subject are well arranged, and interest is maintained by abundant illustrations. These are generally well selected, but in a few isolated cases, more modern examples might, with advantage, have been chosen. The book contains a considerable amount of useful data tabulated for ready reference, which contributes considerably to its value and utility. It should make a wide appeal to the student of management as a text book, to the foreman and plant engineer as a book of reference, and to many managers as a guide on many phases of management which are not as yet sufficiently understood or practised.—H. D.

### Shorter Notices

**Electrodynamics.** By Leigh Page and Norman Ilsley Adams. Pp. 506; figs. 115. Chapman & Hall, Ltd., 11 Henrietta Street, London, W.C.2. Price 32s.

**Ratefixing and Estimating.** By Joseph C. Freeman. Pp. 128; illus. Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d.